I

VOLUME ONE

Fold outs

I

DRAFT ENVIRONMENTAL IMPACT STATEMENT

ORANGE LINE RELOCATION AND ARTERIAL STREET CONSTRUCTION

SOUTH COVE TO FOREST HILLS, BOSTON, MASSACHUSETTS

UMTA PROJECT NO. MA-23-9007
FHWA PROJECT NO. U-393 (1)

U.S. DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION
FEDERAL HIGHWAY ADMINISTRATION

FEBRUARY 1977

GovDoc
Plate only

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared by:
U.S. Department of Transportation
Urban Mass Transportation Administration
Federal Highway Administration

Orange Line Relocation and Arterial Street Construction
South Cove to Forest Hills, Boston, Massachusetts

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

UMTA PROJECT: MA-23-9007
FHWA PROJECT: U-393(1)

This transportation improvement is proposed for funding under title 49, U.S.C. 1601 et. seq. and/or title 23 U.S.C.

The statement is submitted pursuant to Section 102 (2)(c) of NEPA of 1969 (PL 91-190); Section 14 of the UMTA Act of 1964 as amended; and Section 3(d) of the UMTA Act of 1964 as amended.

January 18, 1977
Date

By: Peter Benjamin
Peter Benjamin, Director
Office of Program Analysis

The Draft EIS will be circulated to various Federal, State, and local agencies and to interested organizations and individuals in accordance with the guidelines set by the Council on Environmental Quality, DOT, and UMTA procedures. This statement is being made available through the State and regional clearinghouses, which are listed below. UMTA will receive comments on the draft for 45 days after circulation begins, and will address all substantive comments on environmental issues in the Final Statement.

State Clearinghouse

Office of State Planning
1 Ashburton Place
Boston, Massachusetts 02108

Regional Clearinghouse

Metropolitan Area Planning Council
44 School Street
Boston, Massachusetts 02108

Summary Sheet

Draft Environmental Impact Statement

Department of Transportation, Urban Mass Transportation Administration, Federal Highway Administration

1. Name of Action: Administrative Action

2. Description of Proposed Action:

   A. The Massachusetts Bay Transportation Authority (MBTA) has filed an application for Federal capital grant assistance to UMTA to relocate approximately 4.7 miles of the existing Orange Rapid Transit Line to the Penn Central Embankment extending from South Cove to Forest Hills. The application includes the removal of the existing elevated structure and the establishment of an interim replacement service along Washington Street, and the construction of a 500-car parking facility at the Forest Hills Station. As part of this project the Massachusetts Department of Public Works has filed an application to the Federal Highway Administration (FHWA) for the construction of an arterial street between Sterling Street (Near Ruggles St.) and Forest Hills.

   The proposed relocated Orange Line would consist of two tracks for rapid transit. The existing four-track railroad would be replaced with three new tracks from the South Cove Tunnel portal to Forest Hills. Both the transit and railroad tracks and the station platforms would be constructed in a combination of semi- and fully-depressed sections from a point just south of Massachusetts Avenue to Forest Hills. Nine stations are proposed for constructior at the following locations: South Cove, Back Bay, Massachusetts Avenue, Northeastern, Ruggles St., Roxbury Crossing, Jackson Square, Boylston St., Green St. and Forest Hills.

   B. The application requests capital grant assistance under the Urban Mass Transportation Act of 1964, as amended, and/or Title 23 United States Code including the Interstate Transfer Provision. The total transit portion of the cost is estimated at $474,616, 123. The requested UMTA share of the grant is $379,692,898. The total arterial

street portion of the cost is estimated at $15,000,000.

C. The UMTA project number is MA-23-9007. The FHWA project number is U-393(1).

3. Summary of Effects

A. Long-term Benefical Effects:

1. This project would replace an aged structure with new facilities thereby preventing interruption or termination of Orange Line service in the corridor.

2. This project would encourage economic growth and redevelopment at station sites.

3. Removal of the elevated would create a better environment for Washington Street by eliminating the visual obstructions for drivers and pedestrians, allowing in more sunlight, and eliminating the noise created by trains passing overhead.

4. Access to the core and Northeastern University would be provided, while allowing for future expansion of both commuter rail and rapid transit.

5. Construction of an arterial street would offer a less circuitous and complex route from Forest Hills to the Southeast Expressway.

6. Where it occurs, reduction in the height of the Penn Central embankment would improve visual and community continuity.

B. Long-term Adverse Effects:

1. Depending upon the alternative selected, up to twenty-one(21) businesses would be completely acquired, fourteen(14) partially taken, and the American Legion Post #76 fully taken. Sixty-three(63) households would be relocated.

2. Additional buses along Washington Street would lessen the local air quality due to the increase in total suspended particulates and odors.

3. The construction of the arterial street would increase traffic volumes and truck traffic in the corridor.

4. Depending upon the results of a permanent replacement service study currently underway, service levels along Washington Street may be less than those currently provided. In no case will they drop below those specified for the interim replacement service.

C. Short-term Effects:

1. Construction impacts

   a. traffic and pedestrian disruptions

   b. localized noise and air pollution

   c. possible sedimentation during relocation of Stony Brook Culvert

   d. minor utility interruptions

   e. spoil disposal from embankment removal and cut and cover; spillage of spoil.

2. Removal of the Elevated structure would cause temporary incoveniences to individuals and businesses along Washington Street.

3. When the Orange Line relocation is completed, rapid transit riders along Washington Street will have to use an interim bus replacement service. Riders wishing to use feeder buses and transfer to the relocated Orange Line would have to pay an additional fare.

4. Passengers riding the commuter trains on the Penn Central alignment would have to use alternative routes or modes. Travel time to Back Bay would increase.

5. Passengers at both Forest Hills and Back Bay Stations would be inconvenienced during the relocation.

6. Businesses along the Penn Central alignment would be disrupted during construction.

7. Construction would generate employment opportunities.

D. Effect on Historic Properties and Publicly-owned Parkland (complete discussion in Appendix A)

1. The Albert Street playground would be affected by taking approximately 10 feet. The extent of the impact will vary depending upon the alternative chosen.

2. The McDeavitt playground would be taken and new replacement land would be provided.

3. Several alternatives require partial land taking (0.16 acres) from the Johnson playground, an equal amount of replacement land would be provided.

4. Depending on the alternative selected, from 4 to 10 structures would be taken in the South End Historic District.

5. A portion of the Arborway would be affected. The extent of the impact would vary depending upon the selected alternative.

4. Alternatives Considered:

A. Transit Alternatives: Development of Project Alternatives

1. No-build Option: continued use of the elevated structure with rehabilitation and maintenance.

2. Penn Central Alignment -Preferred

3. Tunnel under Shawmut/Washington Street

B. Alternatives for the preferred transit alignment.

1. Alternative Track Options

2. Alternative Profiles

3. Construction Alternatives

C. Arterial Alternatives

1. No-build: normal maintenance of existing streets

2. Arterial to Jackson Square only

3. Arterial to Forest Hills

D. BTPR: Additional modal and alignment alternatives were considered and are summarized in this document.

5. This Draft Environmental Statement is being circulated to the following agencies:

A. Assistant Secretary on Environment, Safety and Consumer Affairs, U.S. Department of Transportation

B. Council on Environmental Quality

C. Environmental Protection Agency, Regional Office

D. Department of Housing and Urban Development, Regional Office

E. Department of Interior

F. Department of Health, Education, and Welfare

G. Department of Agriculture

H. Department of Commerce

I. U.S. Army Corps of Engineers-Regional Office

J. Federal Energy Administration - Regional Office

K. Federal Highway Administration - Regional Office

L. Federal Railroad Administration

M. Advisory Council on Historic Preservation

N. Interstate Commerce Commission

O. Massachusetts Historic Preservation Officer

P. State Clearinghouse

Q. Regional Clearinghouse

6. This Draft Environmental Impact Statement is being made available February, 1977.

   The Final Environmental Impact Statement is estimated to be available July, 1977.

Based on information included in this Environmental Impact Statement (EIS) and comments received, the Administrator of UMTA in formally approving the project will make the following review and findings required by the respective sections of the Urban Mass Transportation Act of 1964 as amended.

Section 3(d) revised . . . . that the application -

(1) has afforded an adequate opportunity for public hearings pursuant to adequate prior notice, and has held such hearings unless no one with a significant economic, social, or environmental interest in the matter requests a hearing;

(2) has considered the economic and social effects of the project and its impact on the environment; and

(3) has found that the project is consistent with official plans for the comprehensive development of the urban area.

Section 14(b) . . . . the project application includes a detailed statement on -

(1) the environmental impact of the proposed project,

(2) any adverse environmental effects which cannot be avoided should the proposal be implemented;

(3) alternatives to the proposed project; and

(4) any irreversible and irretrievable impact on the environment which may be involved in the proposed project should it be implemented

Section 14(c) . . . . that -

(1) adequate opportunity was afforded for the presentation of views by all parties with a significant economic, social, or environmental interest, and fair consideration has been given to the preservation and enhancement of the environment and to the interest of the community in which the project is located; and

(2) either no adverse environmental effect is likely to result from such project, or there exists no feasible and prudent alternative to such effect and all reasonable steps have been taken to minimize such effect.

TABLE OF CONTENTS - VOLUME I

TABLE OF CONTENTS - VOLUME I (Cont.)

PAGE

PAGE

TABLE OF CONTENTS - VOLUME I (Cont.)

TABLE OF CONTENTS - VOLUME I (Cont.)

PAGE

TABLE OF CONTENTS - VOLUME II

LIST OF FIGURES - VOLUME I

CHAPTER ONE: INTRODUCTION

1.0 INTRODUCTION

1.1 Study Description and Purpose

The findings of the environmental impact analysis for the City of Boston Southwest Corridor Transportation Project presented here includes several major project elements.

The major project elements analyzed (though not necessarily proposed for construction) include the reconstruction of the Orange Line transit and railroad facilities between South Cove and Forest Hills, the construction of an arterial street between Sterling Street (near Ruggles Street) and Forest Hills, a parking facility at Forest Hills, removal of the Washington Street Elevated transit structure and the provision of Interim Replacement Service on Washington Street.

The transit component of the project is intended to provide improved rapid transit service into the densely built southwest area of metropolitan Boston. It provides for continuation and upgrading of long-term commuter rail and AMTEAK services. It also provides for removal of the existing Washington Street Elevated structure built in the early 1900s, between South Portal and Forest Hills.

The provision for replacement services to the South End and to Roxbury where the Washington Street Elevated is removed is the subject of a separate study. A commitment to provide replacement services has been made by the current and previous Secretaries of Transportation of the Commonwealth. This service will be examined in the Environmental Impact Analysis as approved under an UMTA Grant (contract submitted to UMTA for approval on December 8, 1976) so as to result in the provision of such service as part of the phased removal of the Washington Street Elevated structure. Such service is contingent upon approval for capital funding as required by appropriate Federal agencies. An Interim Replacement Service is proposed as part of the proposed Southwest Corridor Project. This interim service will continue indefinitely and will terminate only when a permanent replacement service is in operation.

The proposed arterial street would replace portions of Columbus Avenue and Tremont Street. The arterial street would be designed as a "Parkway" or "Boulevard" with associated landscaping and pedestrian treatment. It is intended to improve traffic operations while strengthening developability of the unused land previously cleared for Interstate Highway 95 South.

The objective of this analysis is to determine the benefits and detriments effecting both the natural and the man-made environment resulting from construction of the project. Beneficial and adverse impacts would include changes to the following:

- Land Use
- Local and regional economy
- Regional and local traffic patterns
- Traffic movement
- Urban fabric of surrounding communities
- Air quality
- Noise
- Utilities

Each of these aspects of the environment are the concerns of this study in terms of potential changes accruing because of construction of the project and its related facilities.

An Environmental Impact Analysis was published on May 21, 1976 and was distributed to 26 town and Boston branch libraries, Boards of Selectmen and the Mayor of the City of Boston, as well as to numerous public agencies and community groups affected by the project. Subsequently, on July 15, 1976, a Public Hearing was held in the Forest Hills area of the Southwest Corridor. As the result of that Hearing and subsequent public meetings with affected community groups and individuals, a revised Project Description and a "Post Hearing Profile" was drawn and adopted as the Proposed Project. This Environmental Impact Statement includes an analysis of this alternative, as well as all previous alternatives discussed.

1.1.1 Project Objectives

The objectives of the Southwest Corridor Transportation Improvements are manifold. Principle among these are:

1. To provide high quality transit and railroad service on an alignment designed to the highest environmental standards achievable in a dimensionally restricted corridor in a dense urban area.

2. To provide a large minority and low-income area of the City of Boston with good internal circulation and access to the core and suburbs. At the same time permit good access to the regional core for suburban residents in an intermodal project with efficient transfers between all modes.

3. To establish a beneficial match between commuter rail and rapid transit to expand the distribution and service characteristics of both.

4. To achieve increased access of the economic and physical redevelopment of the South End, Roxbury and Jamaica Plain as envisioned in the Southwest Corridor Development Plan and in the City's Renewal Plans for the South End and Campus High School.

5. To encourage the major joint development with local community participation of 120 acres of land cleared for I-95 south by the construction of residences, businesses, parks and community facilities (and the streets and transit facilities necessary to serve them); and the elimination of the damaging impact of the vacant land thereby.

6. To remove the blighting influence of the Washington Street Elevated and Penn Central Railroad embankment which for decades has reduced property value and caused environmental damage.

7. To replace redundant and poorly designed street facilities with more efficient roadways which are consistent in configuration and location with land use and development objectives.

8. To divert traffic from automobile to transit in general, and from local residential streets to arterial streets designed for this purpose.

9. To provide full execution of the Southwest Corridor plan of an estimated 16,000 construction and 2,400 permanent jobs and the provision of construction jobs for minority workers and subcontracts to minority businesses.

1.1.2 Study Sponsorship and Guidelines

The project is sponsored jointly by the Massachusetts Bay Transportation Authority (MBTA), as the regional mass transportation agency, and the Massachusetts Department of Public Works (MDPW), as the state highway agency. The impact analysis is part of an application for Federal assistance being made to the U.S. Department of Transportation (USDOT) through its subordinate agencies. These agencies are the Urban Mass Transportation Administration (UMTA) for the construction of the relocated Orange Line and the Federal Highway Administration (FHWA) for the arterial street construction. Depending upon the final configuration of the fringe parking facility at Forest Hills, funding may be sought from UMTA and FHWA.

Because Federal funds may be used for portions of this project, an environmental impact statement is required under Section 102 (2) (c) of the National Environmental Policy Act (NEPA) of 1969. An environmental impact report is

also required under the Massachusetts Environmental Policy Act of 1972. The July 1, 1975 agreement between UMTA and FHWA designated UMTA as the lead Federal agency for this study. Therefore, this document will be processed under UMTA guidelines. This environmental statement follows the initial environmental analysis in the environmental review process for mass transportation projects as specified in UMTA Order 5610 1B, with attachments, and 5610.1, which contain the guidelines under which the study was conducted.

The material in this report serves as the basis for the environmental impact statement required before Federal funding can be approved. As such, it follows the Council on Environmental Quality's Guidelines for the preparation of Environmental Impact Statements (issued August 1, 1973).

1.1.3 Relationship to Other Projects

Several other projects are under discussion for the Southwest Corridor, including areas within the City of Boston, as well as suburban communities. A description and consideration of each is included in Section 4.3 of this document. The projects which are currently included in the Unified Work Program for the Boston Region, or are in design or construction are:

A. Transportation Improvements/Forest Hills to Needham - A consultant is currently under contract to the MBTA to produce an Environmental Impact Statement including rapid transit and commuter rail alternatives on the Needham Branch right-of-way owned by the MBTA.

B. AMTRAK Upgrading - The Federal Railroad Administration is currently making extensive plans for improvement of rail facilities and service in the "Northeast Corridor" from Washington, D.C. to Boston. This includes High Speed Rail and AMTRAK service.

C. Commuter Rail Upgrading - A capital grant has been received by MBTA toward improvements of the Franklin Branch facilities and service. Improvement of the Stoughton and Providence services are anticipated as part of the MBTA's continuing Commuter Rail Improvements Program (CRIP). Acquisition of and improvements to commuter rail rolling stock are a subject of the MBTA's Capital Grant Application for CRIP-Phase II filed September 23, 1975.

D. South End/Roxbury/ Dorchester/Mattapan Transportation Improvements - the MBTA has submitted a proposed contract for Consultant Services to UMTA for an investigation of project alternatives and production of Environmental Impact Statement for improved transportation services for these communities. These services would follow Washinton Street from Downtown to Dudley Station and would diverge from the existing Washington Street corridor easterly via Blue Hill Avenue, Warren Street or the Midland Division to Grove Hall and south.

E. Circumferential Transit - The Central Transportation Planning Staff (CTPS) is currently investigating alternatives for cross-town transportation in the institutional-residential-industrial ring through Boston, Cambridge and Somerville in preparation for an Environmental Impact Analysis. The subject project provides right-of-way reservation for this project in South End.

F. Arborway Green Line - MBTA staff is currently developing a program of improvements to the Arborway Line in cooperation with the City of Boston.

G. South Cove Tunnel Extensions - Capital Grant Application has been submitted by the MBTA and approved by UMTA for this project. Its completion is an element in the provision of the Orange Line service between downtown Boston and South Cove and Back Bay.

H. Midland Division - A Capital Grant Application has been submitted by the MBTA and approved by UMTA for this project. Commuter rail service and AMTRAK trains may be diverted to the Midland Division during construction of the Orange Line* enabling the project to move unimpeded by rail traffic within the immediate area of the construction of the Relocated Orange Line. This project, alone, could provide additional flexibility for railroad operations and would be the basis for transit improvements in the Dorchester, Mattapan, and Hyde Park areas.

I. New Orange Line Cars - A Capital Grant has been received by the MBTA for the purchase of additional 65' long cars for the Orange Line.

J. Orange Line North - Service was initiated in 1975 on the new alignment from Haymarket Station to Malden Center with intermediate stations at Community College, Sullivan Square and Wellington. Further extension to the Oak Grove Station, near the Malden-Melrose Line, will be completed in 1976.

K. Other related transit improvements, such as the Arborway Bus Garage and operating improvements are described in the Transit Development Plan of the MBTA.

* The impacts of the use of the Midland Division on commuter rail and on AMTRAK service is part of this Environmental Impact Statement.

1.2 Study Context

1.2.1 Study Area Location

The general project area is the portion of the City of Boston bounded by the MBTA Red Line Ashmont Branch on the east, the downtown area on the north, the Riverway Arborway parkland on the west, and Cummins Highway on the South. The project begins at the fringe of downtown Boston and extends along the existing right-of-way of the Penn Central Shore Line to the vicinity of the Forest Hills commercial area at Walk Hill Street (Fig. I-1).

1.2.2 Project Description - Rail/Transit (Fig. I-2)

The MBTA's Orange Line runs north and south between Forest Hills and Malden Center. A northern extension to Oak Grove at the Malden-Melrose Line is under construction. The Orange Line is primarily located at grade or on an elevated structure except for the 1.1 miles of subway through downtown Boston under Washington Street, and a new tunnel under the Charles River from Haymarket Station to Community College Station. The elevated portion of the line is located above Washington Street, in the southwest portion of the City of Boston, and generally parallels the proposed relocation section.

The following transit and rail alternatives between South Cove and Forest Hills are the subject of this Environmental Impact Statement.

- No Build/No Action
- Railbed on Modified Embankment (Raised and Widened)
- Railbed Depressed
    - o Full (maximum depth)
    - o Modified (minimum depth)
    - o Post-Hearing (intermediate depth) (The Proposed Project)

These major options, as well as alternatives dropped from consideration, are discussed in detail in Section 4.

Proposed Transit/Rail Facilities

The following transit and rail facilities are proposed to be constructed as a result of this analysis:

- Relocate approximately 4.7 miles of the existing Orange Line from the South Cove area (south of Essex Station) through Back Bay Station and on to Forest Hills. The Line will consist of two tracks and will generally follow the present railroad right-of-way. The southern terminal of this project will be a new station at Forest Hills.
- Replace existing four-track railroad with three new tracks parallel to and east of the transit tracks, from South Cove Tunnel portal to Forest Hills. The tracks would occupy a common right-of-way from South Cove to Forest Hills, diverging at Forest Hills to Providence (Shore Line) and to Needham (Needham Branch), allowing either railroad or transit on the Needham Branch in the future.
- Both the transit and railroad tracks and station platforms would be constructed in a partially depressed section (the Post Hearing alternative) between a point just south of Massachusetts Avenue and a point south of Forest Hills.

- Provide for the possibility of two future transit tracks on the Needham Branch and Shore Line (main line) beyond Forest Hills.

- Remove existing Washington Street elevated structure between South Portal and Forest Hills and provide interim Replacement Service between downtown Boston and Dudley Station until a permanent Replacement Service has been provided.

Nine stations, to accommodate six car Orange Line trains, are proposed at the following locations:

	Rapid Transit	Commuter Rail	AMTRAK
South Cove	X		
Back Bay	X	X	X
Massachusetts Avenue	X		
Northeastern/Ruggles Street	X	X	
Roxbury Crossing	X		
Jackson Square	X		
Boylston Street	X		
Green Street	X		
Forest Hills	X	X	

There are five existing stations in the Washington Street subways: Essex, Washington, State, Haymarket, and North Station. Although some of the platforms at these stations have been lengthened, some are still not long enough to accommodate six of the new 65-foot cars. This project will include lengthening of platforms and associated structural work and finishing at:

Essex (northbound)*

Washington (both platforms)

State (southbound)*

The project would also include finishing work on the already lengthened platforms at Essex (southbound), and Haymarket (both platforms), and State (northbound). With the lengthening of these platforms, all Orange Line stations from Forest Hills to Oak Grove will accommodate six of the new 65-foot cars.

This project allows for the future provision of improved commuter rail service with incremental conversion to Orange Line transit service along the Needham Branch.

No new rolling stock will be required for this project, as no additional mileage will be involved. The 100 existing cars may be modernized or replaced under an additional Capital Grant Application. They would be equipped for radio communication and cab signals. Additional cars may be needed as volume increases, and their acquisition would be provided for in conjunction with transit extensions.

1.2.3 Project Description - Arterial Street (Fig. I-3)

Current arterial travel in the corridor is an arduous task. The existing arterial route from Forest Hills to the core area is negotiated via a connection of streets, each of which is incapable of providing acceptable service.

Two routes are involved which are characterized by truck loadings, local traffic congestion and parking problems. These conditions cause inconveniences to both drivers and pedestrians. The shorter route alternative is Lamartine Street or Amory Street to Jackson Square; Columbus Avenue to Roxbury Crossing; Columbus Avenue or Tremont Street to Massachusetts Avenue. A more circuitous route is Washington Street to Egleston Square, then Columbus Avenue to Roxbury Crossing.

Both routes are discontinuous, have complex intersections and are deficient in traffic carrying capacity.

* Includes Handicapped Facilities.

Lamartine and Amory Streets, designed as residential streets, are deficient as arterials.

The alignment of Columbus Avenue at Roxbury Crossing is extremely poor. In addition, both Columbus Avenue and Tremont Streets have poor surface drainage and deteriorated roadbed and pavement.

The Washington Street elevated transit structure presents the motorist with visual, physical and psychological problems. Piers located between lanes and at odd places introduce obvious restrictions. Additionally, Washington Street, basically a commercial street, serves poorly as an arterial with through motorists, shoppers and delivery personnel in competition for the same limited space.

The proposed arterial street, designed as a Parkway or Boulevard, would start at Massachusetts Avenue at the connection to the Southeast Expressway, follow Ruggles Street in a westerly direction to the Penn Central Railroad, parallel the railroad to its termination at Forest Hills. Total length is about 3.8 miles.

The arterial street has been divided into three segments (Fig. I-3) as follows:

Segment #1 - Massachusetts Avenue to Ruggles Street

Segment #2 - Ruggles Street to Jackson Square

Segment #3 - Jackson Square to Forest Hills

It has been determined by Massachusetts DPW, with the concurrence of FHWA, after a review of engineering drawings, an evaluation of probable impacts, and after public response to newspaper announcements that Segment 1 would qualify as a "non-major action". As such, the National Environmental Policy Act of 1969 (NEPA) does not apply. Consequently, the arterial from Massachusetts Avenue to Ruggles Street (Segment 1) has not been included in this impact analysis.

The alternatives under consideration for Sections 2 and 3 are listed below and fully described in Section IV:

- No Build*
- Build Segment 2 only
- Build Segments 2 and 3

1.2.4 Regional Transportation Planning Context

A rapid transit line located on the Shore Line tracks of the Penn Central has been included in most major regional Planning studies of recent years. Documentation of the proposal for this Relocated Project by MDPW in 1968 and in the MBTA Master Plan resulted in a project for a rapid transit line located in the median of a major expressway leading into the heart of Boston.

* For a No-Build Alternative, only normal maintenance of existing streets would take place. The impact of choosing this option is used as a basis for comparison with the impacts of the Build Alternative. Selection of a No-Build Alternative will not rule out minor improvements to the existing local street system.

In the recent past, regional planning was noted for the emphasis it placed on highway planning. This attitude was changed in the early 1970's when the Governor stopped all new expressway construction within the Route 128 perimeter for a major restudy of the Boston region's transportation needs. Following the study made by the two-year, $3.5 million Boston Transportation Planning Review (BTPR), the Governor decided not to build the radial expressways planned for the region. He decided to rely more on mass transit to move people in the denser core area. The Commonwealth of Massachusetts adopted a "balanced" transportation policy, calling for a combination of transit and highway investments, planned as part of a unified transportation system. The Southwest Corridor studies of the BTPR support the concept of major rapid transit, commuter and inner-city rail facilities on the alignment of the Penn Central trackage, paralleled by new or modified local streets and boulevards in place of the previously planned expressway.

The shift from highway to rapid transit and railroad construction in the corridor has been reinforced by Congressional adjustments to Federal programs for transit improvements. The Federal Highway Act of 1973 gave the states flexibility in using funds previously scheduled for interstate highway construction. Funds allocated for construction of the Southwest Expressway (Interstate 95) have thus become available for transit projects with a strong emphasis on the Relocated Orange Line as the top priority of the corridor.

The Relocated Orange Line has been given a high priority in the region because of its key role in relation to other projects now being planned. Many of the longer-term projects will be influenced by construction of this project for an orderly, scheduled implementation at a later date. In addition, the project has had a relatively long period of gestation and growth, through agency investigation, community exploration and involvement. These elements are reflected in the current Transit Improvement Program for the Boston Region, which includes a summation of the many projects being considered for transit improvements in the region, together with a description and scheduling of projects over the next decade or more. In this tabulation, as in all recent documentation, the Relocated Orange Line is of the utmost importance and highest priority for the region.

Several of the emerging transportation plans build upon the proposed Relocated Orange Line for improved transit service. Chiefly, these are possible future transit extensions beyond Forest Hills to either West Roxbury or Route 128 in Needham, but they include an orderly upgrading of the commuter rail and AMTRAK services which utilize this corridor for access to Boston. These possible future line extensions or improvements have been analyzed in Section 5.1 considering the changes they might produce in transit ridership for the Relocated Orange Line if they were implemented.

1.2.5 Historical Background of Study

The Relocated Orange Line is proposed for a railroad alignment which is one of the oldest in Massachusetts. The line was built as part of the Boston and Providence Railroad Company, chartered in 1831 and first opened to passenger service in 1834. In 1888 the line was leased by the Old Colony Railroad Company, in an effort to forestall impending New Haven Railroad competition with its profitable Fall River - New York passenger steamers on Long Island Sound. The New Haven, however, gained the upper hand under the guidance of J.P. Morgan, who leased the Old Colony system in 1892, thereby completing a through route for the Shore Line between New York and Boston and opening an era of extensive passenger service in the corridor.

Passenger service on the Shore Line and the tributary commuter rail lines sharing the roadbed was so extensive that most early transit extension plans assumed its permanent viability. Early plans for a corridor expressway respected the presence of the rail service, retaining trackage and service on the existing right-of-way. By the mid-1950s, rail service had begun to decline, the proposed expressway joined the interstate highway system, and shortly thereafter, it was recommended that the existing Orange Line on the Washington Street El be relocated to the median of the highway. By 1967, the MBTA and the State Department of Public Works had completed sufficient analysis of the joint expressway-and-rapid transit scheme to embark on initial land acquisitions in the corridor and construction of the South Cove Tunnel.

In September of 1968, the MBTA initiated construction on a segment of the South Cove Tunnel. This new tunnel forms a junction with the existing Orange Line Tunnel at Washington and Kneeland Streets and extends to the right-of-way of the Massachusetts Turnpike. South Cove Station is included within the confines of the tunnel, and is located on Washington Street in front of Don Bosco High School and across the street from the New England Medical Center Hospitals. This project was initiated by the Authority with $13,3 million of 100% local bond funds because urban renewal construction scheduled for the South Cove area could not be delayed and the Federal Government did not have sufficient funds at that time (1968) to assist in the financing of this project. In 1972 the tunnel and the shell for the new Medical Center Station were completed and urban renewal construction has proceeded above the facility.

Clearance for I-95 and the Orange Line involved the relocation of over 700 households and 300 businesses in the communities of the corridor. Most of the clearance took place north of Forest Hills. Damages were not limited to the actual highway takings. Uncertainty about the impact of the highway on properties adjacent to the right of way contributed to a pattern of neglect and inaction. This accelerated neighborhood deterioration along the potential path of the road. The deterioration continues today.

Controversy over the impacts associated with the expressway system mounted and in 1970, further planning and construction was halted pending a full scale review of transit and highway plans in the metropolitan area by the Boston Transportation Planning Review. As part of that review a series of public hearings were held on the findings of the technical effort and the recommendations of community groups, municipal and institutional agencies. On October 30 and 31, 1972 public hearings were held on the Southwest Corridor transit and highway project, attended by an estimated 1700 persons. The speakers at the hearing, while bitterly divided over the question of the proposed expressway, were nearly unanimous in support for the Relocated Orange Line. Transcripts of these hearings are available through the MBTA.

Following the hearings and the major work by the BTPR, the Governor dropped plans to continue I-95 into Boston. He urged top priority for Southwest Corridor transit investment to provide improved mobility for corridor residents, and to spur renewal of the land cleared for the expressway. He also urged further exploration of the merit of depressing the rail facility, and an examination of the means of providing service to replace the loss of the Washington Street El in the heart of the South End and Roxbury. As an integral part of the development plan, the Governor appointed a Development Coordinator in mid-1973 to work with agencies, officials and community representatives toward implementation of corridor transportation elements and land development. Following the completion of the BTPR, the Southwest Corridor Development Coordinator has established consensus around the direction of this project.

This document represents the distillation of the efforts of the MBTA, the Southwest Corridor Development Coordinator, the Central Transportation Planning Staff with cooperation from MDPW, the Metropolitan Area Planning Council and many other agencies. The extensive contact with the community throughout the process has been documented and summarized in Section 1.3.3.

1.2.6 Major Issues

The transcript of the previous Boston Transportation Planning Review and UMTA Capital Grant/FHWA Highway Location and Design public hearings on the Southwest Corridor contain major issues raised by citizens concerned about the project. Residents who spoke at the two hearings expressed concerns that the rail facilities should be depressed below grade to alleviate noise and visual impacts, and that delays in construction should be minimized.

The public participation process which has been underway since the initial hearings has revealed that these issues are still a concern of residents and others were brought up:

1. Disruption during construction.
2. Disposal of spoils from excavation.
3. Details of pedestrian, bus and automobile access to stations.
4. Interest in joint development at station locations.
5. Open space green belt development.
6. Influx of new vehicle traffic from the suburban bedroom communities.
7. Potential high speeds on the proposed arterial.
8. Desire for continued rail commuter service to Back Bay Station during construction.
9. Potential increased noise and vibration due to the added rail and transit traffic expected.
10. Concern for the electric arc flashing during nighttime hours if catenary power is used.
11. Need for security fencing of the rail/transit facility.
12. Concern for personal security within the stations as a result of the project.
13. Changes in property values.
14. Provision of a replacement service between Dudley Station and Downtown Boston.

These items are among those addressed within the specific alternatives described in this report.

1.3 Method of Study

1.3.1 The Technical Analysis Process

An environmental impact analysis is essentially a comparative one. The present is judged against the future. The future with a given project is compared to a future without that project. Based on work by the BTPR, this analysis follows that same logical structure. First, the BTPR study team took an inventory of the existing environmental conditions through field work, interviews, research of published sources, and public meetings. Next, future changes in existing conditions were projected under the assumption that the Relocated Orange Line would not be built. This was done through the use of computer models, professional judgments, interviews with local officials and experts, and experience in similar situations. This set of projections comprised the "No-build" future of the alternative without the project.

The study team prepared a set of alternative configurations for the Relocated Orange Line project, as described in Section 4, and projected future conditions under each of the selected "build" alternatives. The resulting comparisons with the no-build future indicated the impacts attributable to the project and provided much of the material for this report.

The environment in which the project would be built was divided into a number of component parts - the transportation system, air resources, water resources, noise conditions, community and economic resources, and visual character. Each environmental component became an element of the technical study, using the analytic techniques relevant to the particular discipline. Two other study elements comprised the environmental analysis -- the community participation program, described in Section 1.3.3., and the preliminary engineering and design, which provided more precise definitions and specifications for the project alternatives.

The study process did not proceed in discrete steps, but involved continual interactions between the study team members, the community, and appropriate public and private agencies. The result was an exploration of issues and discovery of major community concerns. This in turn, resulted in additions and revisions of the data base to refine and evolve alternatives.

Subsequent to the publication of the Environmental Impact Analysis, an additional Public Hearing was held on the proposed Southwest Corridor Project. As a result of that Hearing, a new "Post Hearing" Profile was examined as an alternative and incorporated in this Environmental Impact Statement. This new Profile has become the basis of the revised project description and is part of the Proposed Project.

1.3.2 Geographic Scale of Analysis

The diversity of the study elements dictated analysis over a variety of geographic scales, from the regional to the site-specific. A set of geographic areas, rather than a single area, was chosen to fit the differing needs of the various elements, with each comprising the "study area" for the appropriate elements.

Regional trends and transportation systems were considered at a regional scale, which included all the communities in the Southwest Corridor. A smaller study area composed of the inner portions of the Corridor was used for traffic analysis and for part of the community and economic studies. A community scale of analysis was defined, covering the portions of Boston which form distinct subareas. This scale proved useful for air and noise analysis, neighborhood and land use analysis and some traffic and ridership studies.

The more physically oriented studies, such as geology, water resources, ecology, visual analysis and design, demanded the smaller coverage and greater detail of a project area scale, typified by graphics showing alignment and station locations. The smallest area used in the analysis was the specific station site, covering the immediate station area.

1.3.3 The Public Participation Process

Work of the Boston Transportation Planning Review intensified the process of public participation in the Southwest Corridor. The BTPR Working Committee, as well as numerous public information meetings and workshops and briefings, brought the BTPR staff together with: representatives from Corridor neighborhoods; regional organizations concerned with transportation, land use and environmental questions; state and local agencies; business and professional organizations; elected officials; and private agencies and organizations. The BTPR's technical staff was made available to participants both at meetings and on an informal, individual basis through the coordination of the Community Liaison and Technical Assistance Staff.

Public awareness of transportation issues in the Southwest Corridor was at a high level. This fact together with immediate problems related to highway land takings, required that the Southwest Corridor participation process be aimed at working very closely with neighborhoods - involving them in the study of long range transportation/land use questions as well as in the solution of short term problems such as the interim use of land that has been acquired by the Department of Public Works.

Work done in the Southwest Corridor subsequent to the BTPR, has increased the scope and intensity of the public participation process. This work remains on-going.

The goal has been to develop a working partnership - expected to last for some years - with individuals, agencies, and organizations throughout the Corridor, and to provide continuous community liaison and technical assistance to be sure that people's concerns will be reflected throughout the long process of Corridor redevelopment. This partnership has led to the refining of alternatives as presented in this document and will continue through the design and construction.

To that end, the following specific techniques have been used:

A. In 1973, a Southwest Corridor Development Coordinator was appointed by the Governor to coordinate the workings of the large number of agencies involved in redevelopment. The Development Coordinator opened a site office at 8 Asticou Road, Jamaica Plain, in approximately the center of the Corridor. The site office maintains a full staff and a complete set of maps and documents having to do with Corridor affairs. It also provides a convenient place for holding small workshops and meetings. The work of the office is well known throughout the Corridor by this time through newspaper publicity, mailings and the publication of a telephone number to be used for all Corridor emergencies and problems. The Southwest Corridor General Mailing List, used to advertise public information meetings and for periodic updates on Corridor affairs, contains 975 names.

B. The Coordinator's office conducted an extensive survey of all groups, agencies and organizations with actual or potential interest in the Corridor. Each has been asked to have a representative sign a Memorandum of Agreement. (See Appendix G) The signatories included private organizations and those state and local agencies having statutory responsibility for Corridor development.

C. All of the signatories of the Memorandum of Agreement make up the membership of the Southwest Corridor Working Committee. This body meets at regular intervals as a policy advisory committee to the Southwest Corridor study process on issues of Corridor-wide concern.

D. A separate committee has been set up in each of the Corridor neighborhoods to deal with purely local maintenance and development issues. Included among these local groups are the Roxbury/South End/Mission Hill Neighborhood Committee and the Jamaica Plain Neighborhood Committee.

E. Special Task Forces have been created to deal with certain Corridor issues that require intensive study. These have been:

- The Task Force on Commuter Rail
- The Task Force on Interim Land Use
- The Task Force on Long-Term Planning and the Scope of Services for Corridor Consultants
- The South Cove Tunnel Task Force

- The Forest Hills-Needham Public Transportation Improvements Steering Committee
- The South End/Roxbury Transportation Improvements Committee (including representatives from Dorchester and Mattapan)
- Task Force on Open Space
- South End/Saint Botolph Task Force (Noise and Acquisitions)

F. Publicity has been extensive; a mailing list is maintained for each committee and meetings are announced at least two weeks in advance, by letter. In addition, most meetings are advertised in local newspapers by way of front page articles describing some aspect of Corridor affairs. Radio spots are used in the case of very large or very important meetings.

Full minutes are taken at each meeting and distributed to every name on the mailing list along with notification of the next meeting. The minutes are complete enough so that anyone missing the meeting will have a very good idea of what was said, by whom, and what decisions were made.

A letter updating Corridor issues is sent out to the General Mailing List approximately four times per year. The mailing lists are continually updated to include all those attending meetings or calling in to request that they receive information.

G. A Public Hearing was held on July 15 and 16, 1976 on the MBTA/MDPW Proposed Southwest Corridor Project. This joint hearing was on the MBTA Capital Grant Application and the MDPW Highway Location and Design.

H. Subsequent to the Public Hearing noted in "G" above, a Task Force on Veritcal Profile was established as a sub-committee of the Southwest Corridor Working Committee in order to discuss a profile which had many of the beneficial aspects of the fully depressed alternative without the high cost associated. The "Post Hearing" Profile now proposed is the result of the concerns of that Task Force.

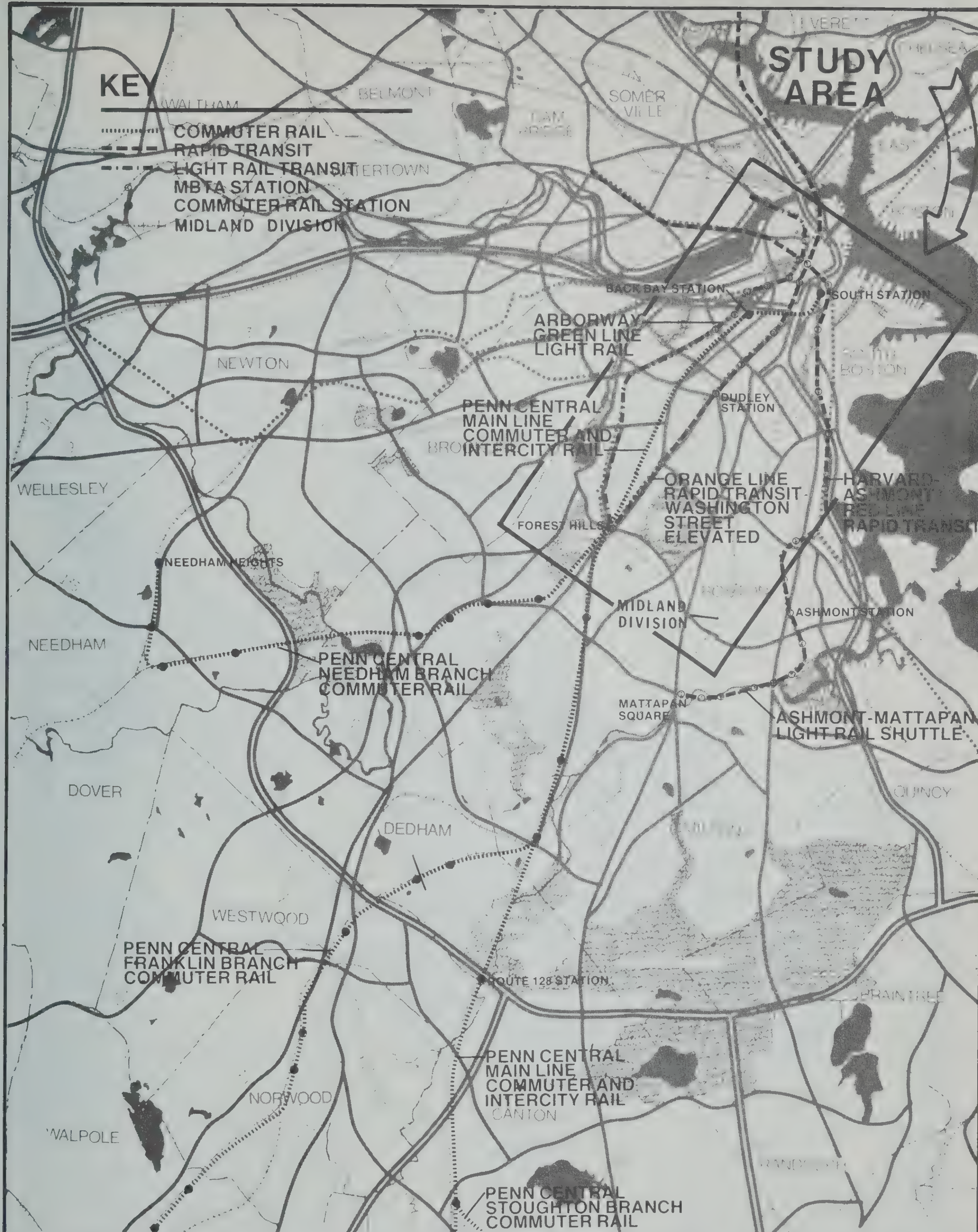
During this process, the MBTA has gone to considerable length to advise merchants and businessment of the Project. All takings by address have been discussed at Neighborhood Committee Meetings. Significant newspaper, television and radio coverage of the Project and of the Public Hearing have preceded the Hearing. Hearing notices indicating that takings would occur were published twice in each of 21 newspapers. Capital Grant Applications listing the takings were available in 44 locations as listed in the July 15 Public Hearing notice. Many businessmen testified at the Hearing. All businessmen who were on the list of takings and who were not in attendance at the Hearing were contacted by mail immediately after the Hearing. They were advised of the Project and of the occurrence of the Hearing, and it was noted that they were not in attendance. Further, they were invited to call questions or concerns to the attention of the Southwest Corridor Development Coordinator and informed that the record would remain open until July 26 for their formal remarks. Several businessmen did call, and have submitted letters for the record as they felt necessary.

The Secretary of Transportation of the Commonwealth, the MBTA, Mass DPW, and the Southwest Corridor Coordinator intend that the process of citizen participation as codified in the Southwest Corridor Memorandum of Understanding (see Appendix G) be extended through the design and implementation phases of the project. They will entertain amendments to the document as processed by the Southwest Corridor Working Committee and endorsed by the responsible public agencies. It is anticipated that task forces, and Neighborhood Committees will continue to meet as may be necessary to encourage a full discussion of issues in the Corridor.

1.4 Organization of the Environmental Impact Statement

This report is organized to fulfill the administrative and legal requirements of the various Federal and State regulations, and to make it easy for readers to find specific information of interest to them. The rest of the document contains the complete environmental evaluation of the project alternatives.

The document consists of seven sections and is organized to parallel the guidelines in UMTA Order 5610.1.1B. It begins in Section 2.0, with a description of the existing environmental conditions. The transportation system need for the Relocated Orange Line is discussed in Section 3.0. The process of defining alternative ways of addressing the transportation needs, and the specific alternative chosen for study are presented in Section 4.0. Section 5.0 details the probable impacts of each alternative and is probably the most important section of the analysis. The adverse environmental impacts are highlighted in Section 6.0 together with means of ameliorating harmful effects. Section 7.0 discusses the short and long-term benefits and consequences of the project against a background of immediate impacts on the region and local communities. Finally, in Section 8.0, the existing commitments to the project and its further resource commitment are tabulated.



STUDY AREA LOCATION

NORTH

SCALE

0 1 2 3 4 MILES

FIGURE
I-1

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

PROJECT LOCATION

RAIL TRANSIT ARTERIAL

LEGEND

- RELOCATED ORANGE LINE & RECONSTRUCTED RAILROAD
- (T) PROPOSED STATIONS
- EXISTING ORANGE LINE TUNNEL
- EXISTING ORANGE LINE ELEVATED
- EXISTING STATION LOCATIONS
- STATION TO BE REMODELED
- ARTERIAL STREET

NORTH

SCALE

0 1200 2400 3600

FIGURE

I-2

RAIL TRANSIT ARTERIAL

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

ARTERIAL STREET SEGMENT MAP

LEGEND

■■■■ ARTERIAL STREET

NORTH

SCALE

0 1200 2400 3600

FIGURE I-3

CHAPTER TWO:
STUDY AREA DESCRIPTION

2.0 STUDY AREA DESCRIPTION

2.1 Physical Setting

The general project area is the portion of the City of Boston bounded by the MBTA Red Line Ashmont Branch on the east, the downtown area on the north, the Riverway-Arborway parkland on the west, and Cummins Highway on the south. The project begins at the fringe of downtown Boston and extends along the existing right-of-way of the Penn Central Shore Line to the vicinity of the Forest Hills commercial focus at Morton Street. Major man-made features are the densely developed older inner neighborhoods of the city; the extensive embankment of the Penn Central; the linear open space cleared for the previously proposed I-95 expressway; the existing elevated transit line extending the full length of Washington Street; the high over-pass of Morton Street at Forest Hills; scattered industrial establishments adjacent to the railroad right-of-way; and the new community facilities and housing created through urban renewal.

Prominent buildings near the alignment of the project include the 60-story John Hancock Tower, the Prudential Center, Northeastern University, the Mission Hill and Whittier Street Housing projects at Ruggles Street, the new Campus High School complex at Roxbury Crossing, the Bromley Park and Heath Street public housing projects at Jackson Square, and the West Roxbury Court House and MBTA Arborway terminal at Forest Hills. (Fig. II-1).

The three most dominating components of the physical surroundings within the study area are unquestionably the Elevated Orange Line along Washington Street, the Penn Central Embankment and the Land Cleared for I-95.

Washington Street Elevated Orange Line (Fig. II-2)

The Orange Line presently operates on an elevated steel structure along Washington Street between South Portal and Forest Hills. There are six stations which serve the elevated along the route. The stations vary in complexity from the simple suspended platform type (Northampton Station) to a combined bus-transit complex at Dudley Station.

The elevated Orange Line was constructed in the early 1900s using a structural system of two column steel bents supporting four large longitudinal steel girders. They, in turn, carry the ties and track for both the north and southbound Orange Line.

A major portion of the line has been constructed using plate girder bents combined with either plate or truss-type longitudinal girders. A third major section extending north and south of Northampton Street Station is constructed of arched truss bents combined with longitudinal truss girders. In the vicinity of Forest Hills stations, the structural system utilizes steel encased in concrete.

Although the structure is currently being painted, the last general painting of the "El" occurred during the 1930's. The southerly end of the structure from Green Street to Forest Hills was painted in the late 1940's. During the construction of the Massachusetts Turnpike (1962-1965) the portion of the "El" passing over the pike was repainted.

The overall height (from street level to top of rail) varies between 25 and 35 feet. The two-track structure has an overall width which varies between 25 and 45 feet placing columns both in the street and on the sidewalks. At stations, the structure widens to allow for platforms and track curvature.

The elevated structure is the most dominating physical feature along Washington Street as it passes through Jamaica Plain, Roxbury and South End communities. Columns conflict with both street and sidewalk travel. Corrosion is prevalent , dripping rust during rain and snow. Noise levels are a substantial 100 dB during transit operations.

Washington Street itself primarily contains retail establishments for the most of its length. Some housing south of Egleston Square and light industry in the area of McBride/Williams Streets are also adjacent to it.

Land Available (Fig. II-3, II-3a)

Approximately 108 acres of land have been cleared for Interstate 95 South or other public purposes in the area between Forest Hills and Massachusetts Avenue. Most of the building demolition occurred between 1966 and 1970. However, demolition continued on a sporadic basis through 1975. In the meantime, the land has remained undeveloped, with the exception of temporary uses north of Forest Hills.

The cleared right-of-way involves a substantial area. This fact, plus the indecision as to its ultimate use, has contributed to the deterioration of surrounding neighborhoods.

The right-of-way was cleared for a width of 300 to 500 feet between the Central Artery ramps at Massachusetts Avenue and Ruggles Street leaving approximately 33 acres barren.

From Ruggles Street to Jackson Square, the clearing was primarily to the east of the existing Penn Central Embankment and on both sides of Columbus Avenue, which parallels this segment. In all, approximately 29 acres are undeveloped in this segment.

Approximately 46 acres of land were cleared primarily to the west of the Penn Central embankment between Jackson Square and Forest Hills. There are several buildings in each segment which still remain within the right-of-way taking line established for Interstate 95 South. Nearly all of these buildings are currently owned by the Massachusetts Department of Public Works and are leased subject to a one-month termination.

A listing of D.P.W. owned structures presently occupied is presented in Appendix I to this project.

Penn Central Shore Line Right-of-Way (Fig, II-4)

The Penn Central right-of-way (as it relates to the Orange Line project) begins at the proposed South Cove Portal located adjacent to and south of the Massachusetts Turnpike Extension beneath Arlington Street. The right-of-way from that location parallels the south side of the turnpike to Back Bay Station, a distance of approximatley 0.6 miles. This section is below the grade of the surrounding terrain. The turnpike is below grade as well. A frontage road is adjacent to the tracks on the south side from Shawmut Avenue to Arlington Street. Commercial buildings abut the right-of-way between Arlington Street and Back Bay Station.

The bridges over the railroad in this section are as follows:

Location	Type of Span
Tremont Street	Steel Stringers
Arlington Street	Brick Arch Spans
Berkeley Street	Through Plate Girder
Columbus Avenue	Steel Stringers
Clarendon Street	Steel Stringers
Foot Bridge @ Back Bay Station	Reinforced Concrete

Many of these structures were built in the late 1800s. Four tracks serve the Penn Central Shore Line in this area.

The railroad right-of-way is generally located below the grade of the surrounding terrain from Back Bay Station to Chickering Tower. The right-of-way gradually rises to meet existing grade in the vicinity of Gainsborough Street.

Within this section (approximately 0.7 miles in length) the right-of-way is abutted by residential buildings. An exception is the Boston Arena and Northeastern University.

The bridges over the railroad in this section include the following:

Location	Type of Span
Back Bay Station Parking Area	Brick Arch on columns
Dartmouth Street	Girder on columns
Signal Bridge	Truss
Follen & Braddock Park Foot Bridge	Truss
West Newton Street	Enclosed Deck Plate Girder
Durham & W. Rutland Square Foot Bridge	Truss
Massachusetts Avenue	Rolled Beams
Gainesborough & Camden Street Foot Bridge	Through Plate Girder

These structures are also estimated to have been built in the late 1800s. The Penn Central tracks are then supported on a man-made earth embankment for a distance of three miles from Chickering Tower near Gainsborough Street to Forest Hills. The embankment was constructed in the mid-1890s and bridged the streets and ways existing at that time. It presents a formidable barrier to cross movement in the corridor. Currently, there are sixteen steel track bridges, a five-span stone arch, and one concrete pedestrian underpass. These structures were built during the original construction and strengthened for heavier loading in 1914.

Bridge crossings are located at:

Location	Type of Span
Ruggles Street	Through Plate Girder Spans
Prentiss Street	" " " "
Station Street	" " " "
Former Station Drive	" " " "
Tremont Street	Steel Arch Spans
New Heath Street	Through Plate Girder Spans
Heath Street	" " " "
Centre Street	" " " "
Atherton (Mozart St.)	" " " "
Boylston	" " " "
Lawndale Terrace	Concrete Arch (Pedestrian)
Green Street	Through Plate Girder Span
Williams Street	" " " "
McBride Street	" " " "
Morton Street	Stone Arch Span
Asticou Road	Steel Arch Span
Walk Hill Street	Through Plate Girder
Washington Street	Through Plate Girder

The Arborway at Forest Hills is the only bridge over the embankment section.

Existing vertical clearances between the local street (under) and the railroad structures in this section range generally from 11 feet to 15 feet. The City of Boston requires 16'-0" vertical clearance over city streets for any new construction.

Four former stations are located within the embankment section: Roxbury Station, Heath Street Station, Boylston Street Station and Jamaica Plain

Station. These stations have been abandoned and all that remains are the concrete platforms and the stairways leading to them. The areas have been fenced off and all of the pedestrian underpasses have been bricked-up with the exception of one. This exception is located at Minton Street and is used primarily by school children attending Our Lady of Lourdes School.

The condition of these structures (rated for 79 mph line speed) is considered fair. They have a rated capacity of 263,000 pounds for a four axle car.

In addition to the four main line tracks, there is one active sidetrack on the embankment near the Green Street underpass.

2.2 The Human Environment

2.2.1 Geography and History of the Area

The City of Boston is located in a basin, a broadening of the coastal plain, defined by a rim of hills and ridges, remnants of a series of fault lines.[1] The hill and ridge definition is strongest in the north, west and south, breaking down in the southwest, where the basin is interrupted by drumlin formations[2] roughly three miles from the State House. This varied hill pattern is broken by two valleys - one following the Neponset River and the other following the original course of Stony Brook. The valleys come together just to the southeast of the Stony Brook Reservation, in the Hyde Park section of the City.

The project area is located in the valley of the Stony Brook, where the early railroad was constructed to take advantage of easy gradients. Further influence of landform on development patterns is illustrated by the closeness of fit between densely urbanized areas and the limits of the Boston basin and the lowland river valleys which pass through the basin's rim. These were the lands easiest to build upon, and they contain the oldest sections of the metropolitan area. The net effect was the creation of Boston basin urbanized area of multi-family dwellings and higher density job concentration, where urban problems and opportunities are most concentrated. This area contains the highest number of people and buildings per acre, and the highest level of disturbing ambient conditions such as deteriorating structures, air pollution, noises, dust and vibration.

The break in the rim of the Boston basin to the southwest permitted high-intensity development that extends almost to Route 128, where the Blue Hills and wetlands of the Neponset watershed provide natural barriers or limits to the pattern of urbanization. Within the Southwest Corridor, little of the original natural ecology has been left untouched by development. Specific parks and reservations have been provided to the great benefit of the residents of the City, but the original watercourse of the Stony Brook has been almost completely placed in culvert.

The landform (Fig. II-5) was a particular determinant in the location of the early roads and first settlements. Early roads in the proximity of the Corridor included: Washington Street (which, before the filling of Back Bay, was the only road along the neck to the Boston peninsula and which then proceeded to parallel Stony Brook), Centre Street and Perkins Street in Boston; and Brush Hill Road and Blue Hill/Canton Street, in Milton.

---

[1]See Section 2.3.3. Geology and Soils

[2]Ibid

Farms were built up throughout the area south of the peninsula. In the latter half of the Eighteenth Century summer estates for wealthy Boston families were established in the Jamaica Plain area because of its scenic values.

The Boston and Providence Railroad was built along the upper Neponset and along the western side of Stony Brook Valley in 1834. Nearby lands were opened up for industry and for residences for commuters.

The latter half of the Nineteenth Century brought rapid changes. In the 1870s the street car line along Washington and Centre Streets from Roxbury to West Roxbury spurred large scale residential growth. Boston's need for parks became a real concern and major urban works by Frederick Law Olmsted resulted in the Boston Park System (the emerald necklace). The Olmsted Park System, which includes the Arborway and the Arnold Arboretum, is now on the National Register of Historic Places.

In 1909 the Forest Hills extension of the Boston Elevated Railway on Washington Street was completed and the rapid development of Roslindale and West Roxbury followed in the classic tradition of "streetcar suburbs".

The waves of growth after each transportation service improvement have resulted in a series of neighborhoods in the Corridor with characteristics representative of the architectural styles prevalent when they were built.

2.2.2. Community Context

2.2.2.1. Neighborhoods (Fig. II-1)

Neighborhood Character - South End, Fenway, St. Botolph, South Cove and Back Bay

The existing Penn Central Railroad forms the boundary separating the South End from Back Bay and the Fenway. However, the railroad may be more significant in providing the boundary between the downtown commercial functions of the Back Bay and the primarily residential sections of the South End.

Since completion of the Prudential and Hancock Centers, and the recently completed Christian Science Complex, Back Bay has become a high intensity adjunct of the older portion of Downtown Boston. Simultaneously the South End has undergone a substantial change through the urban renewal process, which has transformed the section of South End adjacent to Back Bay into a recognized historic residential district.

This section has had great appeal because of its links to Downtown or Back Bay. It has also traditionally been host to the newly arrived immigrants to the City. Vestiges of the ethnic and racial backgrounds are strong in the South End. Tremont Street and Columbus Avenue - parallel to the railroad - are lined with shops of great diversity, reflecting the mix of backgrounds of the people who meet and live together in the South End.

Most of the housing in the South End is constructed in mid-nineteenth century row-houses, except in those instances on the major avenues where urban renewal clearance provided a higher density/replacement building. Commercial facilities are scattered throughout the neighborhood, and most South End residents find other shopping goods reasonably close at hand, either in Downtown, Back Bay, or at Dudley Square. Access to shopping is provided by local bus or by the Washington Street El, which dominates the center of the South End.

Housing stock has deteriorated much more rapidly in the vicinity of the El. Renewal actions here have been somewhat slower, due to the uncertainties surrounding the El's removal. Vacancies in housing are much more pronounced in the Washington Street Corridor. These vacancies may have been mitigated by the massive presence of the Boston University Medical Center and the Boston City Hospital located in an area of the South End which is farthest from the corridor of rails.

By contrast with the South End, the Fenway district contains several small neighborhoods surrounded by large institutions and has the subtantial open space of the Back Bay Fens, or Fenway. Two major museums, six major colleges, and numerous medical institutions focused on the buildings of the Harvard Medical School are in the Fenway. The institutions which are most affected by the Relocated Orange Line are Northeastern University, Wentworth Institute, and the Museum of Fine Arts. Each of them is situated close to the project corridor.

Housing in the area is varied. It contains extensive student accomodations in the vicinity of Northeastern and the Museum. It has the large Mission Hill and Mission Hill Extension housing projects located between the corridor and the Harvard Medical Area complex.

The St. Botolph neighborhood (lying directly adjacent to the existing Penn Central Railroad and extending north to Huntington Avenue) has been variously affiliated with both the Back bay and the Fenway district. Predominately residential, it has an architectural character similar to that of the South End. The St. Botolph neighborhood contains many long-time elderly residents and many transient residents, as well as a number of owner-residents. It is small in area and diversity. It relates directly to the Prudential Center and is clearly affected by its proximity to the railroad.

The South Cove is part of the Central Area and exhibits many of its characteristics such as dense housing, commercial and institutional buildings. It contains the Bay Village neighborhood, the New England Medical Center and is the heart of the Chinese residential community. A large amount of moderate-income, high-rise housing has been built in the past five years along the Massachusetts Turnpike which forms South Cove's Southern boundary.

In the Back Bay, the much delayed 1.5 million square foot John Hancock Tower, which will house 10,000 persons, has recently opened. The mini-tower at Prudential Center is now nearly fully occupied. This represents significant new employment in the area with Boston Gas' and Gillette's corporate headquarters among those adding an estimated 8,000 people to the daily work population.

Several other projects in the area are at various stages of implementation: the 3 million square foot, mixed-use Park Plaza Project, a new Western International Hotel, and a new Bergdorf Goodman Store at Prudential Center. These projects represent the latest execution of the City's "High Spine" concept for growth of the downtown. This concept requires the location of high density residential, office and commercial retail uses in a linear spine connecting the downtown financial district to the Fenway Urban Renewal Area at Northeastern University, as the prime real estate development sector of the core. This spine parallels the alignment of the Penn Central Railroad between South Cove and Northeastern University. Thus, the South Cove/Back Bay transit link is critical in allowing the development of the region's economic base. Without the access it will provide, growth will be hindered and automobile based transportation to this growing sector of the city would be encouraged.

If constructed, the South Cove/Back Bay branch of the Orange Line would directly serve this expanding market and development area. The Green Line has become drastically overcrowded during recent years (in both inbound and outbound directions during the peak hours) owing largely to growth at Prudential and on Boylston Street in Back Bay. Because of its proximity to the trunk of the Green Line, the Orange Line connection to Back Bay will provide much needed relief for those making trips to and from Back Bay and the Boylston Station area of the South Cove. It is predicted that the opening of service to South Cove and Back Bay Stations will relieve overcrowding on the Green Line caused by boardings and alightments at Boylston, Arlington and Copley Stations, as well as draw new riders to the system.

Neighborhood Character - Roxbury and Mission Hill.

The South End and Roxbury merge south of Massachusetts Avenue. The exact boundary is indeterminate, but near Ruggles Street, the area is known as Lower Roxbury. This area was to have been the interchange of two expressways - the Southwest and the Inner Belt - and consequently land takings were most severe in the vicinity. Urban renewal clearance has added to the impact, but gradually new construction has filled the space. The Campus High School is the largest single project. It is closely followed in scale by the sheer volume of new housing throughout the area.

Dudley Square is the commercial heart of the area. It is located on the far side of the Campus High School project some distance from the rail lines. Once the terminus of the Washington Street Elevated Line, Dudley progressed toward major retail status, enhanced by the location of city service office and court functions nearby. The blighting impact of the snaking elevated lines overhead - along with other business factors - have taken a heavy toll on Dudley. Changes in competition from the suburbs has been further aggravated in this inner city area by an actual decline in population and buying power.

Although Dudley enjoys centrality in Roxbury, benefitting residents from South End, Dorchester, and Jamaica Plain, it clearly has an advantage because of its position as an important modal transfer point on the transit network. While rehabilitation is important to maintain Dudley as an important community resource, additional development in the cleared lands adjacent to the rail tracks should be carefully studied to encourage economic revival.

The remainder of the land cleared for the Inner Belt lies to the east of Dudley Square terminating in the South Bay industrial district situated between North Dorchester and South Boston. Boston City Hospital is a major medical institution serving many project area residents as well as the City of Boston generally. It is located at Massachusetts Avenue at the entry ramps to the Central Artery. Many viable manufacturing structures and the Orchard Park Housing Development abut the land cleared for roadway use in the area between Dudley Square and City Hospital.

Mission Hill, to the west of the tracks, is a residential community closely related to the medical complex of the Fenway, but is constantly alert for encroachment by the institutions. The community is crowned by the steep grades of Parker Hill, and centers on the looming Mission Church halfway up the hill. The top of the hill is the site of yet another institution - the Robert Brigham Hospital. Housing is high density, basically three decker construction, with a great many vacant parcels scattered throughout. On the southern portion of the hill some industrial uses remain adjacent to the railroad embankment.

Between Roxbury and Mission Hill, the rail tracks and the cleared land right-of-way is accented by steep grades rising to Parker Hill on the west and Fort Hill on the east. The valley between the two hills has historically been a physical and social divider between the two communities on either side. This division is being broken down by migration of population from Roxbury into Mission Hill areas over the past few years. A similar population division and recent alteration has occurred between Roxbury and the northern portion of Jamaica Plain.

Neighborhood Character - Jamaica Plain

The community of Jamaica Plain begins approximately in the vicinity of Jackson Square and extends on both sides of the embankment to beyond Walk Hill Street on the south side of Forest Hills. The northern boundary extends from the Bromley-Heath project area along Heath Street at the foot of Mission/Parker Hill to the Jamaicaway. The western boundary is the Jamaicaway and Centre Street and includes the Arnold Arboretum area and Moss Hill. East of the Arboretum and south of Forest Hills are several residential areas which blend into Roslindale. The northern portions of these residential areas focus on Forest Hills as a commercial and transit center and are usually considered within Jamaica Plain. The eastern boundary is the cemetery and Franklin Park open space up to Seaver Street. The boundary then follows Seaver to Egleston Square and then Columbus Avenue to return to Jackson Square.

Within this general area are a number of neighborhoods of widely varying age, physical form and socio-economic structure. A sampling to suggest the range of conditions is as follows:

- The Bromley-Park-Heath Street public housing projects. Age 20 to 30 years, 3-story walk-up and elevator high-rise.

- Our Lady of Lourdes parish area. Two- and three-family houses, many owned within a family for two or three generations.

- An institutional area along South Huntington Avenue and including the V.A. Hospital.

- A strong pedestrian oriented commercial section along Centre Street reinforced by a street running trolley.

- A grouping of elderly housing and nursing homes in the Jamaica Pond and Sumner Hills areas. These generally are large, wood-frame houses converted for institutional use.

- Early Twentieth Century large single-family houses along the Jamaicaway and Arborway. These are largely owner-occupied, although many have been subdivided into two or three units.

- Moss Hill is generally suburban in character and was developed between the mid-twenties and early sixties. Incomes and property values are among the highest in the City of Boston.

While these descriptions are very general and not all neighborhoods are included, they show the very great range of social and physical diversities. Unlike the South End where differing socio-economic groups occupy similar structures and live in close proximity, Jamaica Plain neighborhoods are distinctly different in physical as well as socio-economic character and frequently are separated by strong physical boundaries. Thus, there is rarely a Jamaica Plain-wide consensus on a critical issue. Most issues do not affect or interest more than one or two neighborhoods at a time. Jamaica Plain is often taken as a measure of voting patterns of the entire City of Boston because of its balanced composition and historical parallels in this regard.

Recent population movements have transformed some of the eastern and northern precincts into neighborhoods of populations which are racially and ethnically mixed. A mixture of residential and industrial land uses parallel the rail tracks from Jackson Square to Forest Hills. Wide variations exist in the scale and present condition of the housing and industries which border or remain adjacent to the rails.

There are several specific problems closely related to existing transit services within Jamaica Plain:

- The Washington Street elevated structure creates a conflict between automobiles, pedestrians and transit facilities throughout its length.

  It is, perhaps, best represented by the chaos created at Forest Hills, which contains a concentration of commercial facilities closely related to the transit terminus in an environment hostile to both pedestrians and autos. Auto-pedestrian conflicts seem to characterize the portions of Jamaica Plain adjacent to the rail lines. Motorists seeking to bypass Washington Street because of its elevated line obstacles flow through heavily residential streets. Lamartine Street from Boylston Street to Green Street is an example of an attractive residential street overburdened with through traffic. Washington Street therefore continues to fail in its functions to carry traffic. The result is that businesses along its length have been forced to abandon the street to avoid the difficulties it presents.

- The Arborway streetcar line runs along Huntington Avenue, then south along Centre Street and South Street to Forest Hills. The absence of a reserved right-of-way presents severe operational problems to the MBTA and frustrates traffic flow. In spite of these problems the neighborhoods have voiced a strong desire to maintain and upgrade trolley service rather than change to bus service.

- Bus stations at Egleston Square and Forest Hills are unattractive and present environmental and traffic problems.

- The interconnections between bus, Green Line and Orange Line at the Arborway and Forest Hills are split between two locations rather than one. Both facilities (because they are in split locations and are in poor physical condition) contribute to lowering the level of service.

- Route 1 bus and truck traffic is excluded from the Jamaicaway, an MDC auto-only parkway. As a result through traffic filters through local service arterials and impacts on residential and local retail areas.

Jamaica Plain, compared with other inner-suburban neighborhoods, has many environmental and cultural advantages. Its attractiveness as a residential neighborhood is reduced, however, by several negative environmental factors, by noxious and conflicting land uses (especially along the rail corridor), and by antiquated or inadequate city facilities and services. As a result, its future development is perceived to be doubtful by residents and non-residents alike.

2.2.2.2. Community Facilities

The community facilities in progress in the study corridor are shown in Fig. II-1. The proposed alternatives do not require the taking of any community facilities beyond existing Department of Public Works property holdings. Within those holdings, the Third Nail Drug Rehabilita-

tion Center and the Jamaica Plain Area Planning Action Council lease space on a 30-day revokable basis. Several federally sponsored renewal programs (Model Cities Sub Areas 1 and 2, the Campus High, Fenway and South End Urban Renewal Projects) abut the Corridor. Nevertheless, designation of this area, first for a highway and later for mass transit and arterial street improvements, precluded siting of new community facilities within the D.P.W. holdings.

Undoubtedly the takings and continued indecision about re-use of Corridor land has negatively impacted facilities closest to it. Declining service population and an uncertain context for expansion, capital improvements or future locational strategy has had its effect. The decision against an Interstate Highway and in favor of mass transit and redevelopment provides a clearer framework for planning and decision making. Because it is adjacent to an impressive number of regional and local institutions, the Corridor represents increased access and modal choice. The cleared land resource presents a number of sites suitable either to expand existing community facilities or to site new ones. A feasibility study is now underway for the use of land between Jackson Square and Roxbury Crossing as the principal site of the Roxbury Community College.

Discussions with various City officials indicate that Corridor-Land could provide for immediate and long-range public facility needs. Although some are very tentative, city facilities which could be located in the Corridor include: a replacement for the Bowditch-Wyman Elementary School and the District Police Station in Jamaica Plain; the outmoded Police stables south of Forest Hills; the Fuller Elementary School in Roxbury and additions to the Carter School Playground site in the South End. In addition, vacant or underutilized warehouse space near the Corridor might be used to accommodate city warehousing functions currently located in a former public school in the St. Botolph Street Area. Reassigning that use to a suitable structure in or near the Corridor potentially frees that school for use as a much needed community facility in that neighborhood.

Open space planning for the Southwest considers the establishment of a bicycle and pedestrian oriented path linking parks, playgrounds and community facilities throughout its length.

Although originally conceived as a linear trail with lateral connections at Forest Hills and Ruggles Street only, analyzing the existing pattern of open space and community facilities suggests the exploration of additional lateral connectors. In Jamaica Plain the planned Southwest II High School and the existing Agassiz Community School and Saint Thomas High School and Church, point to the importance of the pedestrian environment along Childs and Williams Streets. Strong parish ties indicate similar consideration in the Boylston Street area.

In Roxbury, Highland Street and Martin Luther King Blvd. potentially link the Bromley Heath Housing Project and the Hennigan Community School to the Shellburne Recreation Complex, the Roxbury YMCA, the Boys Club and Boston Technical High School. Historic John Eliot Square and Dudley Station represents another linkage possibility. The Symphony, the Christian Science Center, the Harriet Tubman Center and City Hospital Complex all located along Massachusetts Avenue provide the context for a strong, coherent visual connection between them, keyed by the projected Massachusetts Avenue station.

2.2.2.3. Current Land Use and Zoning (Fig. II-8)

Predominant land use in the project area is residential. It is of higher density (high-rise) at the northern edge of the Corridor in the South Cove, and of lower density (single-family, duplex and three deckers) as the Corridor approaches Forest Hills to the south. However, high-density publicly supported housing developments are located at several locations immediately adjacent to the Corridor.

Local business districts are interwoven with the residential areas and are generally of the corner store or strip commercial variety. Larger aggregations of retail activity in the area are exceptions. Dudley Square is the largest of this type. Other concentrations of retail activity are at Egleston Station, Green Street, and Forest Hills in Jamaica Plain. Lying further from the Corridor are the Central Business District and the Prudential Center Area in Back Bay.

Manufacturing and industrial activity are located adjacent to the railroad right-of-way and the proposed arterial alignment. The greatest concentration of such uses are found at the ends of the Corridor, in the South Bay Area near City Hospital and at Forest Hills.

A number of public institutions are located near the cleared Corridor in the vicinity of Ruggles Street and Roxbury Crossing. These include the Museum of Fine Arts, Northeastern University, Boston State College, Wentworth Institute, Peter Bent Brigham Hospital and many others. Other institutional complexes are Boston City Hospital at Massachusetts Avenue and the New England Medical Center in the South Cove. Although strong tension continues between the institutions and local communities who resent encroachment on their territories, these institutions have a continuing interest in the decisions on the Relocated Orange Line and even more concern about the use of certain lands for their expansion programs adjacent to the line.

Public open space usage adjoins the Corridor: the Fenway at Ruggles Street and Franklin Park and the Arnold Arboretum near Forest Hills.

The most significant characteristic of the Corridor is cleared land. The scale of demolition for highway construction plus the uncertainty as to an eventual decision about the highway has given the cleared strip a "wasteland" character. In Jamaica Plain most takings for the expressway were west of the railroad. Between Jackson Square and Ruggles Street most takings were on the east side of the tracks. From Ruggles Street, cleared land extends to City Hospital.

Before the land was cleared, its use in the immediate corridor was a mix of manufacturing uses (including several industrial areas having rail sidings) with housing interspersed. Much housing was cleared in Lower Roxbury. This has been replaced in the past five years by developments utilizing federal and state assistance.

The Penn Central tracks are located on an earth embankment. Due to its imposing size and narrow openings, the embankment looms as a major physical barrier between communities. It is significant, however, that the predominantly industrial uses existing adjacent to the embankment prior to demolition may have contributed to this sense of community separation.

Current zoning in the project area corresponds very closely to current uses. Much of the cleared land is currently zoned for manufacturing.

2.2.2.4. Federally-Assisted Programs

Several federally-assisted programs are now underway for much of the land abutting the rail corridor (see Fig. II-9). These include the Model City Program, which is coordinating a number of social, economic and physical development programs in six sub areas. Of the construction projects within the Model Cities area, very few abut the Corridor directly. One exception is the elderly housing development on the Holzer-Cabot property south of Jackson Square. Community programs such as the Third Nail drug rehabilitation effort, and the Jamaica Plain Area Planning Action Council (APAC) now lease DPW-owned property within the Model Cities area on a 30-day revocable basis.

The Campus High School Urban Renewal Area is well into construction. A 2,500 student high school and 2,000 student occupation resources center are under construction in an area which abuts the cleared land. The area in question is located between Ruggles Street and Roxbury Crossing. This project includes the Lower Roxbury Community Corporation housing units, several hundred of which have been completed and are being occupied.

The South End Urban Renewal Area is bounded on the west and north by the project Corridor. Back Bay sites and projects likely to be affected by the Relocated Orange Line are concentrated in this renewal area. The proposed new arterial construction in the presently cleared land abuts the South End Urban Renewal Area at its southern boundary.

The remaining urban renewal areas adjacent to the Corridor are the Fenway Project and Washington Park. The Fenway Area plan includes three vacant parcels and one renewal parcel at Massachusetts Avenue adjacent to the railroad. Washington Park is a project area which is substantially complete and does not directly abut the Corridor. However, Martin Luther King Boulevard was constructed in the east-west direction within the Washington Park area and is projected to extend to Jackson Square. It could affect local street traffic and transit service in the Corridor by providing increased vehicular access.

The Corridor is characterized by one of the City's most significant concentrations of public and subsidized housing. Orchard Park, Whittier Street, Mission Hill and Bromley Heath public housing projects abut the Corridor. If projects within two or three blocks of the Corridor are included, there is an estimated public housing population of at least 15,000 persons within the Corridor area. Publicly subsidized housing recently constructed include Academy Homes, various South End Urban Renewal housing sites, and the Lower Roxbury Community Corporation housing within the Campus High School Renewal Area. Many of the more recent developments are subsidized federally utilizing the vehicle of the Massachusetts Housing Finance Agency.

2.2.2.5. Open Space

The Southwest Corridor, because of its long linear configuration, interfaces parks and playgrounds of many varieties between Forest Hills and the South Cove Area. Relatively little parkland actually falls within project boundaries, but the fact is that the Corridor runs so close by, that it has implications for these existing open spaces.

In addition to its proximity to local parks and playgrounds, the Corridor closely parallels elements of the historically significant Olmsted Park System.

The Olmsted-design Boston Park System which became a model for park planning throughout the country, includes the Back Bay Fens, the

Fenway, the Riverway, the Jamaica Way and Jamaica Pond, the Arboretum and Franklin Park. All of them are within walking distance of the Corridor. John Eliot Square in Roxbury, the Christian Science Center in the Fenway Area and Copley Square in Back Bay are significant urban open spaces. They are also within a short woalk from the Corridor.

Close examination of the adequacy and distribution of open space resources in the vicinity of the Corridor reveals an interesting contradiction. Using the City of Boston goal (10 acres of open space per thousand population divided between local and regional facilities*) as a measure, it is clear that Corridor neighborhoods are well served by regional facilities but lacking in local open-space amenities. This deficit is especially apparent near the Bromley-Heath and Mission Hill public housing projects and in the Boylston Street area of Jamaica Plain. In these areas limited facilities exist for older children and young adults. Very little is available for smaller children and infants.

Nearby community facilities will be taken up in more detail later. Their locations, however, their adequacy and the populations they serve have important implications for possible uses of Corridor land. As a case in point, there are several existing schools whose play facilities do not meet modern standards for school construction. There are other new schools planned for the area, but they are in densely built neighborhoods on small sites which could benefit from expanded site opportunities.

It is against this background of historic precedent, open space deficits and location pattern of parks, playgrounds and public facilities that a framework for Corridor-wide open space planning has emerged. The rare occurrence of so much cleared land, between Forest Hills and Massachusetts Avenue, stretching through so many neighborhoods provides the opportunity to develop a nearly continuous path from Franklin Park and the Arboretum at Forest Hills to Copley Plaza and beyond. This spine can serve both a linking function between open spaces, community facilities and places of interest and can provide, within it, open space activities of infinite variety.

While a linear network of linkages is an obvious opportunity, certain lateral linkages appear desirable also. The most important perhaps is the restoration of a direct connection between Franklin Park and the Arboretum which currently has been destroyed by the complicated system of ramps, streets and viaducts which characterize Forest Hills. Other important lateral linkage opportunities include pedestrian and bicycle connections to facilities along Martin Luther King Blvd., an open space link between the Fenway, the New Campus High School complex and the City Hospital complex, pedestrian-oriented connections to Symphony Hall and the Christian Science Center and to the developing Dartmouth Street Mall.

It will take vision, insight and cooperation from the critical agencies and departments, but with adequate funding, a system of safe and pleasant paths, can connect local and regional parks, the Symphony, the Museums, Fenway Park, the National Museum of Afro-American Artists and many other amenities throughout the Southwest area. An aggressive, innovative and coordinated approach to the design of Southwest open space can result in a visual and functional continuity. It would have positive benefits to the Boston community at large for many years to come.

2.2.2.6. Publicly-Owned Park Land and Historic Sites

Section 4(f) of the Department of Transportation Act states that "after the effective date of the Federal-aid Highway Act of 1968 the Secretary shall not approve any program or project which requires the use of any publicly-owned land from a public park, recreation area or wildlife refuge of National, State, or local significance, as determined by the

*Source: "Open Space in Boston-Goals and Policy Recommendations", BRA, December-January, 1971-1972

Federal, State or local officials having jurisdiction thereof, or any land from an historic site of National, State or local significance as determined by such officials unless. (1) there is no feasible and prudent alternative to the use of such land, and (2) such program includes all possible planning to minimize harm to such park, recreation area, wildlife and waterfowl refuge, or historic site resulting from such use."

Details of the analysis of possible impact on publicly-owned park land and historic sites are shown in Appendix A. The procedures outlined in Section 4(f) of the Department of Transportation Act, Section 106 of the National Historic Act and Executive Order 11593 were followed in order to identify properties already on the National Register and to locate, inventory and nominate properties to the National Register. **A memorandum of agreement with the Advisory Council on Historic Preservation will be included in the Final Environmental Impact Statement.**

Information on impacts and measures to minimize harm has been prepared at a level of detail consistent with the present level of project design. The design incorporates the results of consultation and comments from agencies and individuals having jurisdiction over the lands and sites discussed in Appendix A, received prior to, during and subsequent to the Public Hearing held on July 15 and 16, 1976. Additional detailed information regarding impact and minimization of harm can be provided only as the exact engineering features of the project are finalized. It should be noted that subsequent project design efforts may, in some cases, either aggravate or reduce the level of impact as discussed in Appendix A.

2.2.2.6.1 Publicly-owned Park Land

The following publicly-owned park lands will be affected by the proposed project:

Albert Street Playground: Bromley Heath Housing Project

McDeavitt Playground

Johnson Playground (not in use)

The proposed project will allow relocation and reactivation of the presently abandoned McDeavitt Playground and better utilization of both the Albert Street and Johnson Playgrounds by incorporating them in the proposed continuous open-space greenbelt which will parallel the transit alignment. Therefore, it is anticipated that the proposed project will not adversely effect this publicly-owned land. As indicated in Appendix A, both the Metropolitan District Commission and Boston Housing Authority concur with this evaluation (these agencies currently own the park land properties involved).

2.2.2.6.2. Historic Sites

The following historic sites or properties will be affected by the proposed project:

Olmsted Park System: removal of stone railroad viaduct at Forest Hills

South End Historic District: demolition of structures located at:
254-264 Columbus Ave
18-28 Cazenove St.
18 and 20 St. Charles St.
90, 92 and 95 Berkeley St.
389 and 390 Mass. Ave.

As indicated in Appendix A, the Metropolitan District Commission concurs with the evaluation that removal of the viaduct, together with the proposed transportation and green belt improvements, can serve to strengthen the linear park concept originally envisioned by Olmsted.

After consideration of all feasible alternative designs for the proposed project, a review of the criteria of effect according to the procedures of the Advisory Council on Historic Preservation (36CFR Part 800); and consultation with the Massachusetts State Historic Preservation Officer it was determined that after the removal of the South End structures listed above, several steps will be taken to minimize the impact. (The two vacant structures at 389 and 390 Massachusetts Avenue may be retained subject to the findings of examination during the engineering phase of work to determine the feasibility of underpinning and retention.)

Details of the measures which will be taken are discussed in Appendix A. In general, the character of the affected historic sites will be respected in all new construction. New open spaces will be created and brick, iron railings and other indigenous materials will be used. The Massachusetts Historic Commission was invited to nominate representatives from the South End Historical Society, Boston Landmarks Commission and Back Bay Architectural Commission to review all proposals for services received from consultants for engineering and architectural design, so that they might offer advice to the MBTA on the choice of consultants. Station design will be reviewed with local residents and the Historical Commission nominees during the preliminary design phase.

During the Public Hearings, concerns were expressed regarding the design of the new stations which border the Historic Districts, and suggestions were made regarding the retention of certain architectural features. While the station itself is not of particular historic architectural significance and is not located within a Historic District, the iron and glass canopy along Buckingham Street is of high architectural quality. The MBTA will make every effort to incorporate this element into the new station design. Similarly, a facade from one of the Elevated stations (preferably from the Dover Street Station) will be examined for inclusion in one of the new Orange Line Stations serving the South End. If the copper cladding material can be removed without significant damage, every effort will be made to incorporate it in the new facility.

2.2.2.7. Population and Housing

The Southwest Area population is decreasing, as may be seen in Fig. II-10. During the period from 1960 to 1970, the Inner City communities experienced dramatic declines in population, greater than that for the Southwest Subregion as a whole. The Inner City communities, including those in the vicinity of the proposed project, had population declines of 13.3 percent. The South End and Roxbury, for example, had decreases of over 25 percent.

The decentralization trends of population which have been occurring in Boston during the past 20 years were somewhat accelerated by public actions in the Inner City, most notably by considerable building demolition involved in urban renewal and highway projects in the South End and Roxbury. Due to the lengthy process between original displacement and reconstruction of housing units these projects caused some of the residents to move, not only out of the community but out of the city as well. Other public actions, including the acquisition for the expressways in the Southwest Corridor, also hastened the decline in population in the Inner City areas.

The racial composition in the Inner City area has undergone major change since 1960 with increases in black and Spanish-speaking families. Over 90 percent of the non-white population in Boston lives in the Southwest. In 1970, 16 percent of the total City population and 27 percent of that in the southwest communities were black. Black population increased in all localities except the South End. However, due to a much larger decline in total population, the proportion of blacks in the South End increased as a percentage of the total population. The proportion of non-whites to white population increased in all communities, most notably in Roxbury. In Roxbury, increases in the percentage of non-white population were due primarily to an out-migration of whites, reflected both in overall population decline and a relatively small increase of non-whites.

Fig. II-10 and Fig. II-10a shows the areas which experienced change in population between 1960 and 1970. Project area communities, despite an overall decline in population, still maintain the characteristic high density associated with older Inner City areas (see Fig. II-10b). Overall density levels have stabilized somewhat, particularly in the large areas of new housing construction and rehabilitation in South End, Roxbury, and portions of the Fenway. In some deteriorated areas where public projects have not been effected, high vacancy rates have appeared and have lowered the overall density of population.

Between 1960 and 1970, total housing units decreased in the City of Boston relative to population in the South End, Roxbury, and the Fenway. In the Fenway and South End, population per occupied unit increased. During the same period, the number of persons per unit decreased in Roxbury, perhaps indicating a loss of larger units. The number of total units increased slightly in the Central Area, Jamaica Plain, and Back Bay. More substantial increases occurred in Roslindale, Hyde Park, West Roxbury, and South Dorchester.

Fig. II-11 shows comparisons of 1960-1970 housing characteristics in the Souhtwest Corridor. With the exception of Hyde Park and West Roxbury the overall vacancy rates increased from 1960-1970, despite a loss in total units. Highest vacancy rates occurred in the South End and Roxbury. (See Fig. II-11a for major housing locations.)

The characteristics of housing stock in Boston also changed in the last decade with the number of single-family decreasing at a more rapid rate than total units. This is particularly true in the South End where single-family homes decreased by 69 percent, compared to 43 percent decline in total units. Single-family homes account for 30 percent of total stock in Southwest Boston, while 56 percent of all units are renter-occupied. Thus, at most, only half of owner-occupants live in one-unit structures. By contrast, virtually all owner-occupants in the Southwest localities outside Boston live in single-family homes.

Renter-occupied units increased at a greater rate than one-unit structures in those Southwest Boston communities where there were increases in total units. The only exception was South Dorchester. West Roxbury evidenced the largest increase in total units or 33 percent. Its renter-occupied units increased by 139 per cent, compared to a 10 percent increase in single-family homes. Median rent (gross housing costs per month) increased from $80 in 1960 to $105 in 1970, a change of 31 percent. Greatest increases were in the South End and the Fenway. The lowest rates of increase occurred in North Dorchester, and Mattapan.

Despite a large rate of increase in 1970, median rent, at $86 per month, was lowest in the South End. In 1960, the South End also held the low median monthly rent of $49 per month. Median rents of $123 to $143 per month in West Roxbury, Fenway, and Hyde Park were highest.[1]

---

[1] All Preceding Housing Data was obtained from the BTPR-Southwest Report, September, 1972.

Significant housing developments built in the period 1960-1970 which are located near the Corridor are listed below.

Prudential Center	Back Bay	781 units
Castle Square	South End	602 units
Back Bay Manor	Mission Hill	298 units
Charlesbank Apartments	Mission Hill	257 units
Back Bay Towers	Mission Hill	146 units
Academy Homes	Roxbury	515 units
Forest Hills Apartments	Jamaica Plain	195 unts

Many housing developments have been constructed since 1970. The early 1970's was a period of substantial real estate activity although more recently there has been a significant showing of construction of all types. A considerable amount of this activity has been by smaller or individual owners who have rehabilitated existing residential units in the South End, Back Bay, Roxbury, and Jamaica Plain either for the private or subsidized market. The Massachusetts Housing Finance Agency has financed many of these developments as well as larger new construction housing developments. The Back Bay has experienced a surprisingly large number of condominium conversions.

The following is a tabulation of significant housing developments located near the Corridor and constructed since 1970.

Tai-Tung Village	South Cove	224 units
Mass Pike Towers	South Cove	198 units
Parcel R-4 (abuts Quincy School)	South Cove	150 units (under Construction)
Roxse House	South End	364 units
Westminster E. William Place	South End	279 units
Methunion Manor	South End	150 units
Camfield Gardens[1]	South End	135 units
Piano Craft Guild (rehab.)	South End	174 units
West Newton St.[1] (rehab.)	South End	136 units
Church Park	Fenway	508 units
Garrison (St.Botolph St.)	Fenway	134 units
Mission Park	Mission Hill	775 units (under construction)
125 Amory Street	Jamaica Plain	234 units
Forbes Bldg.	Jamaica Plain	147 units (under construction)
Smith House	Roxbury	132 units
Haynes House	Roxbury	131 units

Currently there are two significant housing proposals near the Corridor which are in the processing stage.

Symphony Towers (Mass. Avenue at Huntington Avenue)	Fenway	400 units
Madison Park Townhouses	Roxbury	120 units

---

1 As of March 1, 1974 there were 1912 conventionally financed rehabilitated units of a total of 3406 rehabilitated units in the South End. (Source: BRA)

2.2.2.8. Economic Characteristics.

The Boston region is now acquiring the characteristics of a maturing economy. It has a slow growth rate and a shift from a manufacturing to a service base. While this trend toward service employment conforms to that of the national economy, Boston exhibits it more strongly than other metropolitan areas. In fact, Boston is a national leader in the provision of some basic services such as finance, management, education, medicine and related research. At the same time, however, Boston has sustained an absolute decline in the manufacturing sector.

In spite of a decline of manufacturing jobs in the metropolitan area and a decentralization trend, it is significant that over two-thirds of the regional manufacturing jobs are located within two miles of Boston City Hall in downtown Boston and in the communities of the South End, South Boston, North Dorchester, East Boston, and Charlestown. Concentrations of manufacturing jobs in cities such as Cambridge and Somerville also reinforce the importance of the regional core as a major employment center for blue collar jobs. Other manufacturing job opportunities influencing the southwest area are located outside Boston, in Quincy, and other suburban communities around Route 128. Except for a concentration of manufacturing and wholesaling employment in Readville (Hyde Park), the remaining portions of Southwest Boston account for less than 15 percent of the total manufacturing employment.

The changes in composition of industries and in each industry's employment requirements are having an impact upon the employment structure of the metropolitan area and consequently on economic mobility and opportunity. Fig. II-12 shows the 1967 through November 1975 structure of employment in the Boston SMSA.* Over the time period covered, the Boston area has lost employment in manufacturing at a rate of 2 percent per year. Note also the sharp downturn in construction and transportation employment since 1971. Fig. II-13 focuses on the employment characteristics of those communities in the southwest section of the metropolitan area. Note that between 1960-1970 occupation fields which exhibited significant growth were in the professional, clerical, and service areas.

The least growth is in the operative workers and craftsmen categories, with managers and sales workers showing only slightly greater growth. This change in occupational structure suggests that job opportunities in the future may center more upon professional and clerical job categories, implying higher levels of required training. Further, this occupational structure may impose problems for persons who do not easily achieve professional training and status, especially women and members of minority groups.

The Southwest Section of the metropolitan area contains the greatest concentration of the region's lower-income, minority population. They are heavily concentrated in the Inner City portions of Boston, including the project Corridor. This section has been losing population and gaining some jobs, but it still has the highest unemployment, the lowest incomes and among the area's poorest housing conditions. Comparative income levels in the Southwest communities of Boston as shown in Fig. II-14 include the percentage of those considered to be below the poverty level. Information on the inner and outer Southwest suburbs is included to show the dramatic differences in income distribution within the Corridor.

---

*SMSA = Standard Metropolitan Statistical Area
(includes 17 cities, 61 towns)

Although the percentage of individuals with lower income is basically the same throughout the Corridor, the Inner City includes a substantially higher percentage of families below the poverty level. The distribution of family income by ethnic groups shown in Fig. II-15 for the South End is typical for the Inner City neighborhoods in this analysis. In terms of absolute numbers, the Inner City contains far more persons and families below the poverty level than the inner or outer suburbs. Individuals below the poverty level in the suburbs are much more likely to be elderly than are those in the City where only one-third of the indivduals below the poverty level are over 60 years of age.

Unemployment is probably the single most critical problem in the subregion. It is the inherent problem of an area with a high concentration of a low skilled, poor, disadvantaged minority. Language barriers are a further disadvantage for a large number of Spanish-speaking residents.

During mid 1975, a special survey of unemployment was conducted by the Massachusetts Division of Employment Security (MDES). The prime purpose of the survey was to develop unemployment estimates for all sections of the City of Boston. It showed an approximately 17 percent unemployment rate in Roxbury and in the South End.

"The sample represented only persons receiving total unemployment compensation benefits, but by inflating this sample to cover persons not receiving any form of compensation, an estimate can be developed for total unemployment. It should be noted, however, that a much larger percentage of black and Spanish-speaking persons are not eligible for unemployment due to inadequate earnings. Thus, a neighborhood like Roxbury or the South End would tend to have a much larger share of persons in total unemployment than projected from this study."[1]

Unemployment rates for 1970, for the 1975 MDES Study and the percent change, are shown in Fig. II-16.

Unemployment rate trends for the United States, Massachusetts and the Boston SMSA from 1970 to May 1975 are shown in Fig. II-17.

The severity of the subregion's unemployment problems is made clear by comparing Fig. II-16 with Fig. II-17. The rate in some communities is more than double that for the United States.

Demographic characteristics of unemployed persons surveyed by MDES in 1975 are shown in Fig. II-18 and Fig. II-19. White males, 26 to 45 years of age show the highest percentage unemployed in predominately white communities such as Back Bay, South Boston, Roslindale, and Hyde Park. Black males of the same age group dominate the South End, Roxbury and South Dorchester.

The low percentages of Spanish males is undoubtedly due to the fact that large numbers of them were not eligible to be surveyed since they do not receive unemployment compensation.

The Southwest Section of the Boston Metropolitan Area -- that area affected by the corridor development -- possesses most of economic problems characterizing the inner core of larger U.S. cities:

- Growing functional unemployment due to major shifts in the area's occupational structure;

- Growing structural unemployment owing to educational and other social barriers to upward shifts in job areas; and

- Growing number of families below the poverty threshold.

---

[1] Area Manpower Review - Boston Massachusetts SMSA (MDES, May, 1975)

2.3 The Natural Environment

2.3.1 Air Quality

Among other factors, the air quality of a region is directly related to the quantity of various pollutants emitted into the local atmosphere. In the project area, the greatest contaminant emissions are from transportation sources - automobiles, buses, and trains. The principal pollutant emitted by these mobile sources are carbon monoxide, unburned or partially burned hydrocarbons, oxides of nitrogen, and particulate matter. Gasoline-powered motor vehicles contribute the greatest quantity of these pollutant emissions. In addition to transportation sources, other activities in the project area affecting air quality are steam-electrical power generation facilities, fuel combustion in boilers for space heating and process heat, and solid-waste incineration. These stationary sources emit principally sulfur dioxide and particulate matter.

Sources and Effects

Carbon monoxide (CO) is the most prevalent of all air pollutants in urban areas. CO emissions result from the incomplete combustion of fossil fuels. It is a highly stable gaseous contaminant related predominantly to automobile exhaust. Since CO is relatively inert and generally emitted at ground level, the concentrations tend to maximize close to the source (a freeway, for example), and the pollution problem is usually localized.

The principal toxic action of CO is a result of its combination with blood hemoglobin (Hb) to form carboxy-hemoglobin. This compound interferes with the life-sustaining transfer of oxygen from the lungs to the body tissues and the return of carbon dioxide from the tissues to the lungs. The presence of relatively small amounts of CO result in significant interference with essential cardiovascular-respiratory functions. Relatively brief exposure to high levels (40ppm) can impair time interval discrimination, visual acuity, and other psychomotor functions. An exposure time and level associated with normal commuter freeway driving is adequate to produce these effects.[1] Longer exposure and higher levels may cause headaches, drowsiness, and eventually respiratory failure and death.

Hydrocarbons are a family of organic compounds consisting solely of hydrogen and carbon. The largest component of world-wide hydrocarbon emissions is non-reactive methane from natural biological sources and is of lesser concern than reactive compounds. The chief sources of the reactive species are man-made and arise from the incomplete combustion of gasoline by motor vehicles, industrial process evaporative losses, and other fuel use activities. There are no known direct health effects from exposure to hydrocarbons at levels found in the atmosphere. The major known pollutant effects of reactive hydrocarbons result from their interaction with nitrogen oxides in the atmosphere to form photochemical oxidants.

Photochemical oxidants (O_3) are not directly emitted by any man-made source in significant quantities. Rather, they are a class of atmospheric pollutants which arise from a complex series of photochemical reactions between hydrocarbons and oxides of nitrogen in the presence of sunlight. The observed effects of photochemical oxidants include eye and respiratory irritation, increased aging of red blood cells, impaired delivery of oxygen to the body tissue and shortness of breath. Associated problems include damage to vegetation, the fading of textiles, dyes, and paint and the cracking of rubber.

Nitrogen oxides arise mainly from high-temperature combustion processes which are followed by rapid cooling. Motor vehicle emissions and the burning of coal, oil, and natural gas are the principal sources. In addition to contributing to the formation of photochemical oxidants, nitrogen oxides have

---

[1] "Instrumentation for Environmental Monitoring": Air, Environmental Instrumentation Group, Lawrence Berkeley Laboratory, University of California, Berkeley, California, December, 1973.

several direct damaging effects. Nitrogen dioxide (NO_2) exerts its primary toxic action on the lungs. High concentrations are lethal to most animal species, causing pulmonary edema. Epidemiological studies have correlated NO_2 concentrations with increases in respiratory diseases in people. Chronic plant injury is associated with exposure to NO_2. Associated problems include decreased visibility, textile fading and deterioration, and corrosion of electrical wiring.

Sulfur dioxide (SO_2) arises mainly from the combustion of coal and petroleum by stationary sources. SO_2 in the presence of fine particulates and water vapor can form sulfuric acid deep in the lungs. Studies have linked SO_2 with the incidence of acute respiratory diseases and their associated mortality rates. In addition, laboratory experiments have found sulfur dioxides to be damaging to animals, plants, building materials, art works, textiles, and paints. SO_2 is also thought to be the cause of acid rain in many areas.

The current controversy over the use of catalytic mufflers on new model cars concerns the possibility that they may cause the formation of sulfuric acid mist in the automobile exhaust from the small amounts of sulfur present in gasoline. Based on the most recent EPA test results from August 1975[1], it now appears that both noncatalyst cars and catalyst equipped cars without air pumps emit very low levels of sulfuric acid at all speeds. By contrast, catalyst cars equipped with air pumps emit high levels of sulfuric acid at highway speeds. It is this potential for high emissions that led the EPA Administrator to suspend the 1977 hydrocarbon and carbon monoxide standards. Without the suspension, manufacturers might have added air pumps to 1977 model cars to meet the stricter standards. In addition, EPA is expected to promulgate emission standards for sulfuric acid in early 1976 to insure that the implementation of stricter emission standards for carbon monixide, hydrocarbons, and nitrogen oxides will not cause a concurrent health hazard from sulfuric acid emissions.

It is now generally agreed that particle size is a major factor in determining the toxic effects of airborne particulate matter. In general, pulmonary deposition increases as particle diameters decrease, with particulate matter less than 1 µm* in diameter of primary importance. Recent studies have shown a number of potentially toxic trace species, including lead, cadmium, antimony, selenium, nickel, vanadium, zinc, cobalt, bromine, manganese, sulfate, and benzo[a]pyrene, predominate in small, lung-depositing particles in most urban aerosols.

In urban areas, the bulk of total suspended particulate matter (TSP) in the air is due to fuel burning, industrial processes, and road dust. Chronic exposure to high concentrations of particulate matter can be injurious to the lungs. Particulate matter is responsible for atmospheric turbidity and reduced visibility, and it is also thought to affect the earth's energy balance through changes in the earth's albedo and absorption of radiation. There is concern over ambient concentrations of lead particulates in urban environments since lead is known to be a poison. The major source of such airborne lead is the burning of gasoline containing lead additives. In general, only about 1-2 percent of the particulate matter in urban areas consist of lead particulates.[2] For an average urban adult, about 25 percent of the normal daily intake of lead will come from inhaled particulate matter; the remainder will be absorbed from food and water.[3]

---

[1] Environmental Reporter, Volume 6, No. 19, p. 762.

[2] Ludwig, J.H., Morgan, G.B., and McMullen, T.B., "Trends in Air Quality", presented at the national meeting of the American Geophysical Union, San Francisco, California, December, 1969.

[3] Natusch, D.F., and Wallace, J.B., "Urban Aerosol Toxicity: The Influence of Particle Size", Science, 185: p. 695-699. November, 1974.

*1 µm= 40 millionths of an inch

Air Quality Standards

National Ambient Air Quality Standards for all of the above-described pollutants (except lead) have been promulgated by the Environmental Protection Agency; these are presented in Fig. II-20. Standards for the Commonwealth of Massachusetts are identical to the federal standards. The primary standards are intended to protect the public health, while secondary standards are designed to protect the public welfare from any known or anticipated effects. The target date for attainment of national primary and secondary standards was May 31, 1975. Achievement of these standards in Metropolitan Boston, however, has been extended to mid-1977 to allow sufficient time to implement a Transportation Control Plan. To meet air quality standards, Boston must control emissions from motor vehicles to a greater extent than will be afforded by the federal new car emission controls. The Boston Transportation Control Plan is composed of a series of land use and transportation control procedures. The proposed program has four main elements:

1. An inspection and maintenance system, to ensure that the pollution control equipment on each registered automobile remains in suitable working order (effective August 1, 1976).

2. A program of parking restrictions and other incentives for reducing single-passenger commuter automobile use (effective October 15, 1973 through March 1, 1977).

3. Additional local hot spot strategies to control CO levels in areas where they are highest (effective May 31, 1977).

4. Implementation of organic solvent use regulations to reduce the emissions of reactive hydrocarbons (effective May 31, 1977).

Current Air Quality

The Commonwealth of Massachusetts Bureau of Air Quality Control (BAQC) operates air quality monitoring stations throughout the Metropolitan Boston region. The nearest operating monitoring station to the project area is located on Southampton Street in the South Bay section of Boston. Pollutants measured at this site are NO_2, SO_2, and TSP. Observational data from this site recorded during 1974 indicates that none of the federal and state primary and secondary standards for these pollutants were exceeded during the year. The annual arithmetic mean and maximum daily concentrations for SO_2 were 0.004 ppm and 0.032 ppm, respectively, far below the standards of 0.030 ppm and 0.140 ppm. The annual arithmetic mean concentration for NO_2 was 0.038 ppm, below the standard of 0.050 ppm. Finally, the annual geometric mean and maximum daily concentrations of TSP were 59 $\mu g/m^3$ and 119 $\mu g/m^3$, respectively, each below the standards of 60 $\mu g/m^3$ and 150 $\mu g/m^3$.

Measured data on ambient concentrations of CO and O_3 in the project area are not available. However, data from other sites in the region indicate that violations of the 8-hour CO and 1-hour O_3 oxidant standards of 9 ppm and 0.08 ppm, respectively, occurred throughout Metropolitan Boston in 1974. In addition, a short-term (62 days) monitoring program conducted for the Boston Transportation Planning Review[1] along the Massachusetts Turnpike Extension and the Southeast Expressway not far from the project area in the summer of 1972 revealed repeated violations of the 8-hour CO and 1-hour O_3 standards.

---

[1] Willis, B.H., et.al., Air Quality Monitoring Program, prepared for the Boston Transportation Planning Review by Environmental Research and Technology, Inc., January, 1973.

In conclusion, excessive levels of CO and O_3 are currently the major air pollution problems in Metropolitan Boston. For this reason the Boston Transportation Control Plan has been developed to reduce CO and hydrocarbon emissions in the region to acceptable levels within a reasonable time frame.

2.3.2. The Existing Noise Environment

2.3.2.1. Noise Scales

In order to understand the existing noise environment and how noise from the proposed project may affect this environment, it is first necessary to understand various scales that are used to measure environmental noise.

Three noise measurement scales are used in this report to describe the present noise environment and to estimate the future noise environment. These scales are necessary to address single noise events and to address various regulations and criteria. The three scales have two things in common: first, they are all measurements of the "Sound Level", and second, they are all "A-Weighted" measurements. The three scales differ in the manner in which the time varying nature of sound is taken into account. The terms, "Sound Level" and "A-Weighted" are explained briefly below, followed by an explanation of how the noise measurement scales differ.

The term "Sound Level" has a very specific meaning. It is used to refer to a logarithmic measure of small rapid pressure fluctuations in the air. A decibel (abbreviated dB) is the scale unit for twenty times the logarithm of the ratio of the fluctuating pressure amplitude to a fixed reference pressure. The logarithm of the pressure amplitude is used because human perception of sound correlates more closely to this than it does directly to the pressure amplitude. It is, however, not necessary to understand the mathematical definition of Sound Level and decibels to judge the loudness of a given sound. To help orient the reader to the magnitude of typical noises, the Sound Level of several common noise sources are shown in Fig. II-21. The following rules of thumb are useful when considering the magnitude of changes in Sound Levels:

- A change of one decible is usually only detectable under laboratory conditions.
- A change of approximately three decibels is detectable in the field. For example, if the difference in noise level between two successive trucks or trains is 3 decibels or greater, this would be noticeable.
- An increase (decrease) of ten decibels is usually considered a subjective doubling (halving) of the sound level, and such a change is significant.

The second item that all the noise scales discussed in this report have in common is that they are all A-Weighted sound levels. This takes into account the sensitivity of the human ear as it relates to the frequency or pitch of the sound. A Sound-Level meter that one can use to measure noise is just as sensitive to sounds with low pitch as it is to sounds with high pitch, but the human ear is not equally sensitive to these different pitches. Therefore, sound-level meters are equipped with electronic filters that de-emphasize both very low-pitched and very high-pitched components so that the level that is read correlates well with our human perception of loudness. Such a filter is called an A-Weighted filter.

All of the noise measurement data and the predictions of this study are given in terms of the level that would be obtained by measuring the noise employing such an A-Weighted filter.

The Sound Level scales used in this report are listed in Fig. II-22. These scales were chosen to describe peak noise events and to address various regulations and criteria. The reader is referred to the section on noise impact criteria in Appendix H for a further explanation of why these scales were chosen.

2.3.2.2. Ambient Noise Measurements

The purpose of the noise measurement program was to determine present noise levels in the study area. This is necessary in order to assess possible changes in the noise environment that may result from implementation of the proposed project. Such an assessment is required by both FHWA in Policy and Procedure Memorandum (FHPM7-7-3) and UMTA in their Order 5610.1.

The sites where noise measurements were made for this project are shown in Fig. II-23. In general most of the sites can be classified as sites that are particularly sensitive to noise. Included are Boston City Hospital, playgrounds and housing that could be affected by relocation of rapid transit operations from Washington Street to the Penn Central alignment, and the construction of a new arterial road. At each of these sites the noise was measured for 24 hours with an instrument that samples the sound level eight times every second. This type of measurement gives a full statistical description of the variation of the sound for each hour of the day and for the day as a whole.

A summary of the noise measurement results is presented in Fig. II-24, and the results of the noise measurements at the Northeastern University/Carter Playground site are shown in Fig. II-25. Similar results for the other sites are included in the Appendix H. The following discussion describes the present noise environment in the Southwest Corridor Study Area.

In general, environmental noise levels in the study area are high. The day-night sound level (L_{dn}) at the 12 measurement sites range from a low of 64dB at Madison Park to a high of 80dB at Boston City Hospital, at 31 Cumberland Street, and at 20 St. Charles Street. The L_{dn} at most sites is in the mid 70's, situations which would be classified by the U.S. Environmental Protection Agency as very noisy residential areas. In general the major noise sources in the study area are traffic on arterial streets, the present elevated MBTA Orange Line on Washington Street, trains along the present Penn Central alignment, and for one short segment the Massachusetts Turnpike.

One of the major objectives of this Environmental Statement is to study the elimination of the present elevated MBTA rapid transit line along Washington Street. Noise levels near this structure during the passage of a train are extremely high. Peak passby sound levels at measurement Site No. 7 (6 Chilcot Place) were in the mid to high ninety decibel range. This site was approximately 100 feet from the elevated structure. Noise levels at some of the nearer buildings and directly under the elevated structure are approximately 100 to 110dBA. These levels are loud enough to cause speech interference inside the closest residences even with the windows fully closed.

Several noise measurements were taken along the Penn Central alignment because it is the alignment proposed for the relocation of the MBTA Orange Line. Between Forest Hills and Massachusetts Avenue, the facility is on an embankment. Generally this area is bordered by houses that are 200 feet or further from the track, industrial buildings, two major housing projects adjacent and a portion of Northeastern University.

Noise levels from the diesel engine trains (and two gas turbine trains) that use this right-of-way are approximately as high as for the elevated Orange Line on Washington Street, however, volumes are not nearly as high and people do not live as close to the tracks. The worst noise condition along this section of the alignment is probably at the Bromley-Heath Housing project. One building here is approximately 100 feet from the alignment, and peak noise levels reach 100dBA during the passage of a train. It should be kept in mind that one reason peak noise levels are so high near this alignment is that most diesel-electric locomotives are not muffled.

Further north, between Massachusetts Avenue and Back Bay Station, the same trains pass. The major difference here is that row houses directly abut the rail alignment on the north side of the tracks. Two measurements were performed in this area. On the north side of the tracks a measurement was made at 31 Cumberland Street at a window that faces the tracks. Peak noise levels here exceed 110dB and the L_{dn} was 80dB, a level that exceeds by approximately 10dB what EPA would classify as a very noisy urban residential site. On the south side of the tracks a measurement was made at 76 West Rutland Square. This site, on a street that is perpendicular to the rail alignment, was approximately 150 feet from the nearest track. Peak levels during the passage of a train are in the mid 90's and the L_{dn} was 70dB. Vibration is also a problem here; the passage of passenger trains at 30 mph is clearly perceptible in the nearest houses.

The measurement site at 20 St. Charles Street overlooks not only the Penn Central alignment but also the Massachusetts Turnpike. Peak noise levels here were not quite as high as a few other locations, but the L_{dn} was 80dB and the FHWA design noise level of L_{eq} 67dB was exceeded by more than five decibels for every hour of the day. The measurements indicate that the Turnpike contributes more to average noise levels than trains.

The Whittier Street, Madison Park and Boston City Hospital measurements were performed because these sites may be affected by noise from the new arterial street rather than train or rapid transit noise. The noise environment at Whittier Street is controlled by traffic on Tremont Street, Columbus Avenue and Ruggles Street. The noise level near Madison Park was the lowest of all the measured sites, but it would still be considered a noisy urban residential area based on its day-night sound level. The noise here is controlled by local traffic. Noise levels at Boston City Hospital are very high, peak noise levels in excess of 100dBA and an L_{dn} of 80dB were measured. The dominant noise source in this area is local traffic, especially trucks. There is a major access ramp from the Southeast Expressway just one block from the hospital, and Massachusetts Avenue is a truck route leading from this ramp.

2.3.3 Geology and Soils

A brief description of geological sequential events and processes responsible for the surface features of the project area is as follows:

- Oldest rocks in the Boston region, Braintree Slates, (formed 500 million years ago) intruded by rocks of volcanic origin; diorite, Quincy Granite.
- Long period of weathering and erosion, rocks rotted and broken up, forming deposits of gravel, sand and clay hundreds of feet thick.
- Pressure on bottom layers of deposits so great that, combined with natural cementing agents, a rock was formed - Roxbury Puddingstone, a conglomerate of rounded boulders and sand resembling plum pudding.

- Layers of pure clay also deposited and hardened to shale - which with continued pressure turned to slate.

- Earths crust so weakened, in West Roxbury, that red hot lava periodically poured out from deep in the earth to form a volcano.

- Formation of conglomerates, slates and lava continued for more than a million years until so great a thickness built up to cause cracks and settlements (faults) in the earths surface triggering many earthquakes.

- Shifting of bedrock caused earth's surface to wrinkle, forming arch hills (anticlines) of conglomerates, slates and lava.

- Advance and recession of glacial ice sheets, of great depth, for more than a million years substantially altered the bedrock surface. Hills were worn down and great blocks of rock carried along and ground up to settle, when the ice melted, in haphazard mixtures of clay sand, and gravel (glacial till). This till was sometimes formed into large rounded hills called drumlins.

- As the climate moderated, great blocks of ice broke away and floated off as icebergs. Some blocks settled in sand deposits and when the ice finally melted, large depressions called kettle holes remained. Some became filled with water and are now ponds.

Conspicuous among the geological features in the area are great masses of Roxbury Puddingstone in Roxbury, West Roxbury and Dorchester; slate in Roxbury and Dorchester; volcanic rocks in Mattapan near the Neponset River; anticlines in Roxbury and the southern part of Dorchester; ledge smoothed and polished by glaciers in Franklin Park; drumlins throughout the area; a kettle hole near the Children's Museum in Jamaica Plain; Jamaica Pond and the beautiful Scarboro Pond in Franklin Park.

The Roxbury volcano became extinct some one hundred million years ago and the cone has been entirely worn away.

Soils data and subsurface conditions for the project extracted from previous reports, together with information from public agencies, indicate that the northern portion of the Penn Central Railroad is located on man-made filled reclaimed area in the Old Back Bay estuary of the Charles River. The fills consist mainly of sands and gravels, but some packets of a heterogeneous dumping of clays, bricks and silts have been encountered. Some of the reclaimed area is underlain with organic deposits of varying depth. In many areas extensive deposits of Boston blue clay exist. Overlaying many of the blue clay deposits are 10-20 foot layers of still yellow clays that have weathered and dried out to provide relatively high bearing pressures. Bedrock throughout the northern area consists of conglomerates and may be expected to be overlain with boulders, hardpan and compacted gravels.

The southern portion of the corridor from Roxbury Crossing to Forest Hills has limited sections of man-made fills, in isolated swampy sites. The area is overlain with a thin (2 foot) layer of organic soils below which is approximately 50 feet of granular material consisting mainly of sands with intrusions of gravel and silt.

2.3.4 Water Resources

The project area lies entirely within the Stony Brook and Back Bay drainage basin. Surface runoff flows through storm drains into the culverted Stony Brook, which crosses the Corridor in three locations - at Roxbury Crossing, Forest Hills, and Ruggles Street.

Well-point data indicates that ground water will be encountered 2 to 15 feet below ground throughout most of the alignment.

Public water facilities are supplied from a central source by the Metropolitan District Commission. Within the corridor, several large water mains cross the proposed alignment of the project. Public sewage services, also supplied by the MDC, are provided throughout the area. Most of the principal water and sewage mains cross the proposed transit project at right angles.

2.3.5 Vegetation and Wildlife

The study area is predominately an urban one characterized by high-density residential structures and some industry. The only concentrations of vegetation and wild life are found at Forest Hills at the extreme southern end of the project. There is a children's zoo at Franklin Park as well as a public recreational and educational animal display -- a habitat exhibit of birds and animals. At the Arnold Arboretum, there is a living collection of 6,000 varieties of hardy trees and shrubs on 265 acres.

2.3.6 Archaeology

The office of the State Archaeologist is of the opinion that no appreciable archaeological impact will result from this project. (See letters which follow.)

Commonwealth of Massachusetts Office of the Secretary
Massachusetts Historical Commission
294 Washington St, Boston, Massachusetts 02108 (617) 727-8470

OFFICE OF THE STATE ARCHAEOLOGIST
BRONSON MUSEUM, 8 NO. MAIN ST.
ATTLEBORO, MA. 02703

January 6, 1976

Mr. Peter Mazza
Vice President
FREDERIC R. HARRIS, INC.
67 Long Wharf
Boston, Mass. 02110

Dear Sir :-

I have studied the map of the proposed project which involves the Penn Central embankment between Forest Hills and Mass. Ave. It appears to me that any significant archaeological site would have been destroyed in the original construction project and that there is no possibility of archaeological impact in the present project.

very truly yours
Maurice Robbins
Maurice Robbins
State Archaeologist

MR/clr

#

Commonwealth of Massachusetts
Office of the Secretary
Massachusetts Historical Commission
294 Washington St, Boston, Massachusetts 02108 (617) 727-8470

OFFICE OF THE STATE ARCHAEOLOGIST
BRONSON MUSEUM, 8 NO. MAIN ST.
ATTLEBORO, MA. 02703

November 10, 1975

Mr. Peter Mazza
Vice President
FREDERIC R. HARRIS, INC.
67 Long Wharf
Boston, Mass. 02110

Dear Sir :-

I have checked the map of the proposed aterial street from Forest Hills, along the Penn. Central R.R. to Ruggles Street and compared it with the archaeological survey maps.

The type of construction to be undertaken and the previous disturbance in the area leads me to the judgement that no appreciable archaeological impact will result from this project.

Very truly yours

Maurice Robbins

Maurice Robbins
State Archaeologist

HARRIS - BOSTON
NOV 12 1975
#

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

PROJECT AREA

PROMINENT LANDMARKS
NEIGHBORHOODS
AND
COMMUNITY FACILITIES

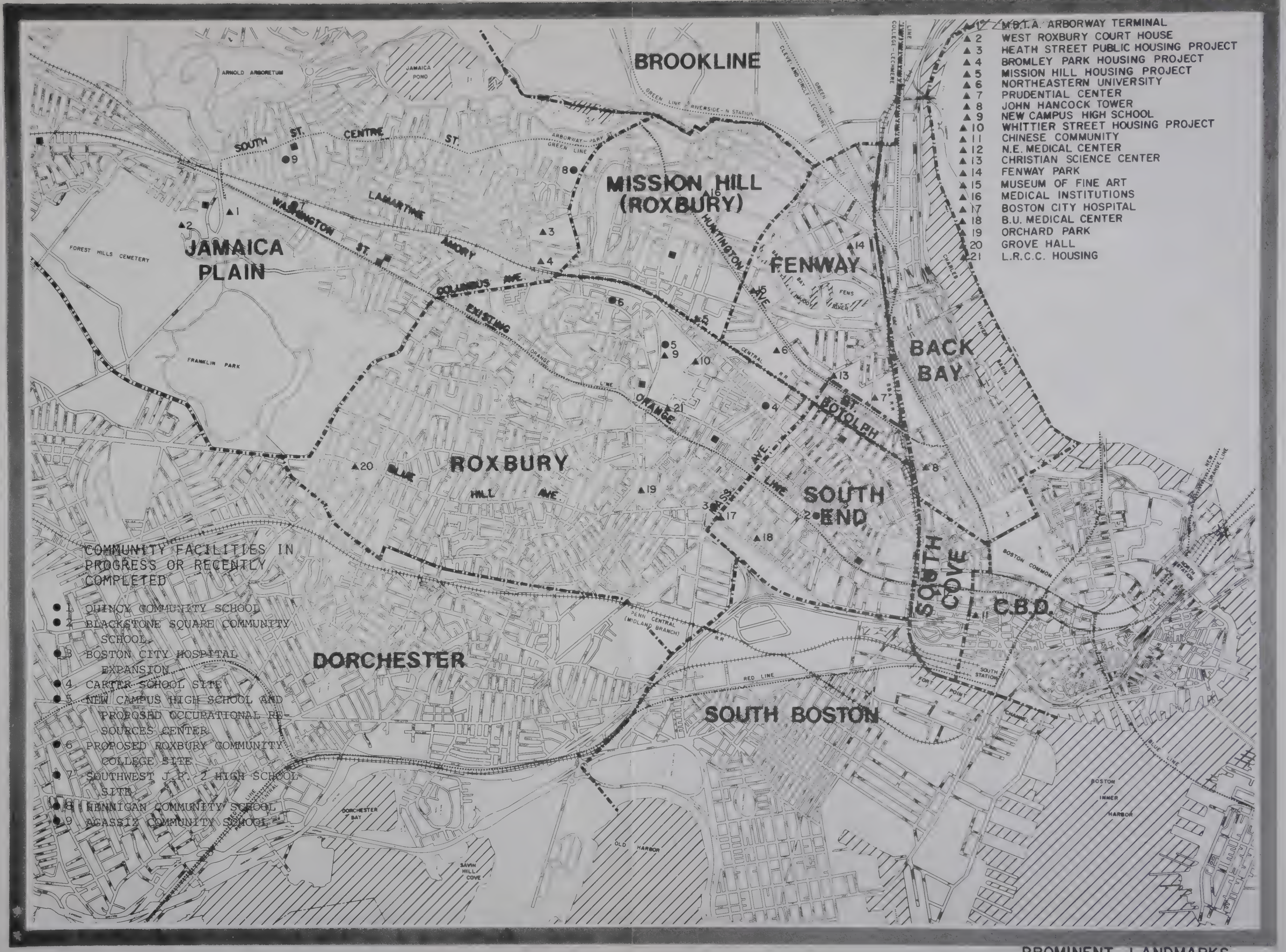
LEGEND

- ▲4 IMPORTANT LANDMARKS
- ●4 NEW COMMUNITY FACILITIES
- ■ NEW RECREATION / COMMUNITY CENTERS / HEALTH CENTERS

SCALE

0 1200 2400 3600

FIGURE II-1



PROMINENT LANDMARKS

est Hills El and Rail Embankment

hington St., Roxbury

Washington St., South of Eggleston Square

Dudley Station Bus Ramp

hington St., North of Dudley Station

"El" Tail Track at Forest Hills

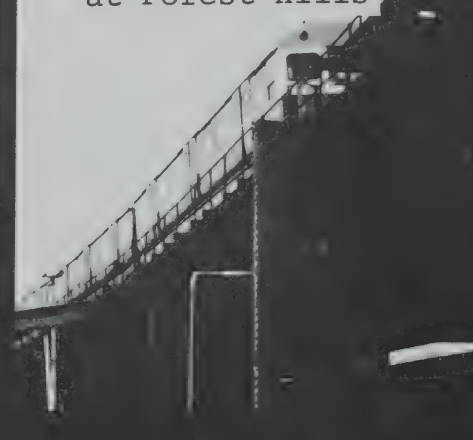


FIGURE II-2

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

PROJECT AREA
PROPERTY MAP

LEGEND

PROPERTY OWNED BY D.P.W. OR OTHER PUBLIC AGENCIES OR CLEARED, PRIVATELY OWNED LAND.

SCALE

0 1200 2400 3600

NORTH

FIGURE II-3

PROPERTY MAP

Terrace Street, Roxbury


Proposed Green Belt Area Between Lamantine St. (to left) And Railroad Embankment

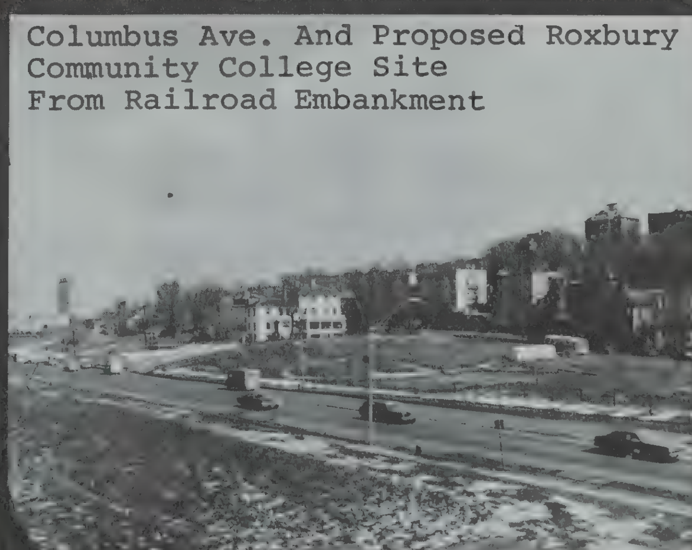
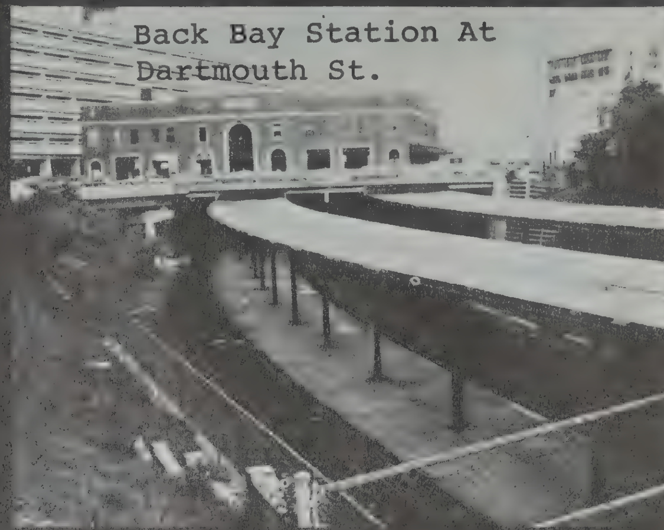

Columbus Ave. And Proposed Roxbury Community College Site From Railroad Embankment

FIGURE II–3A

Pedestrian Underpass, Jamaica Plain



Back Bay Station At Dartmouth St.

Abandoned McDevlit Playground (Foreground) At Boylston St., Jamaica Plain

FIGURE II-4

View Of Mission Hill Housing From Penn Central Railroad Embankment

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

PROJECT AREA

LAND FORM

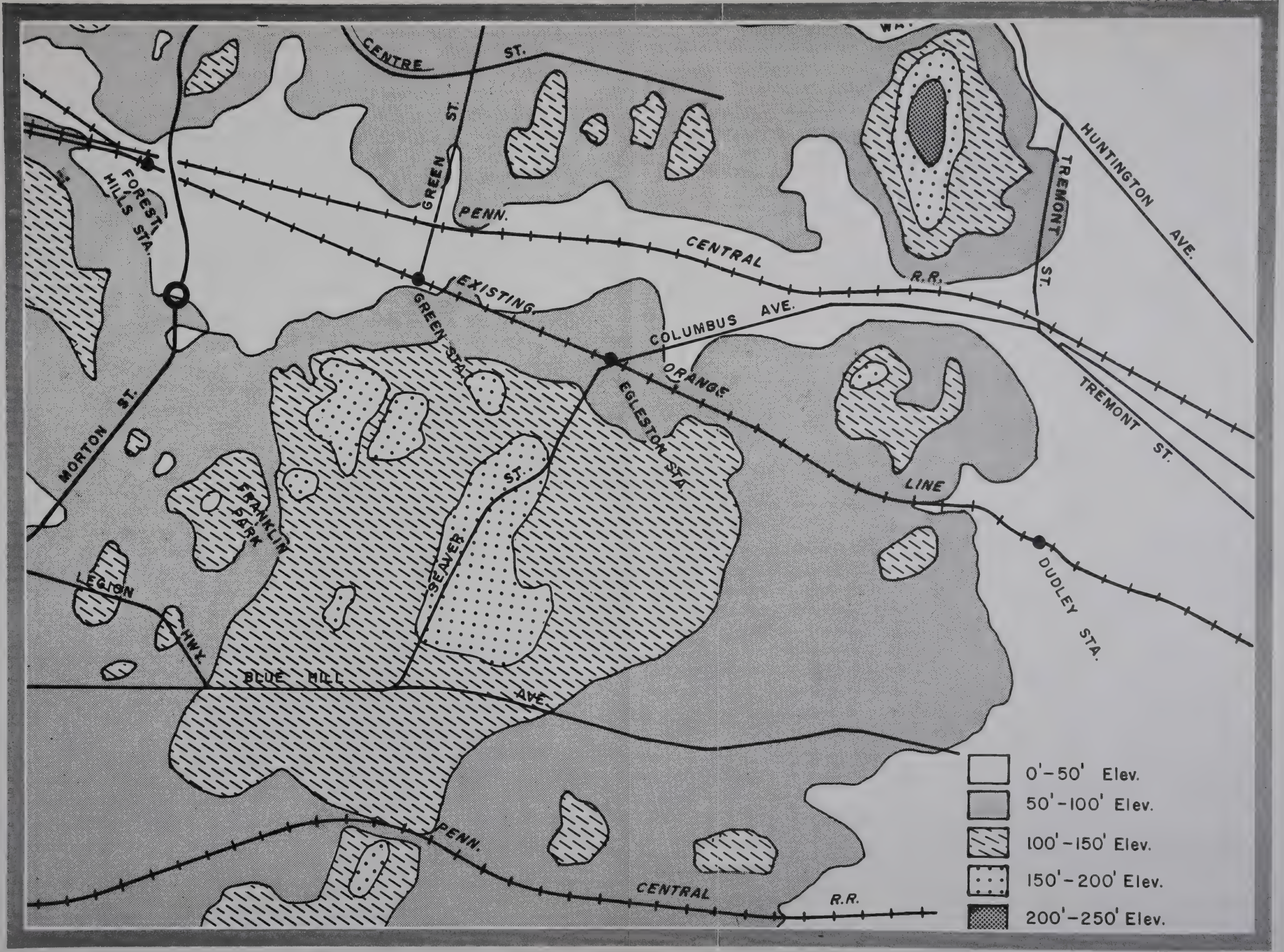
SCALE

0 1200 2400 3600

NORTH

FIGURE

II-5



SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

PROJECT AREA

EXISTING LAND USE MAP

LEGEND

- OPEN SPACE
- INDUSTRY
- INSTITUTIONAL
- BUSINESS
- CLEARED LAND
- RESIDENTIAL

SCALE

NORTH

0 1200 2400 3600

FIGURE II-8

LAND USE MAP

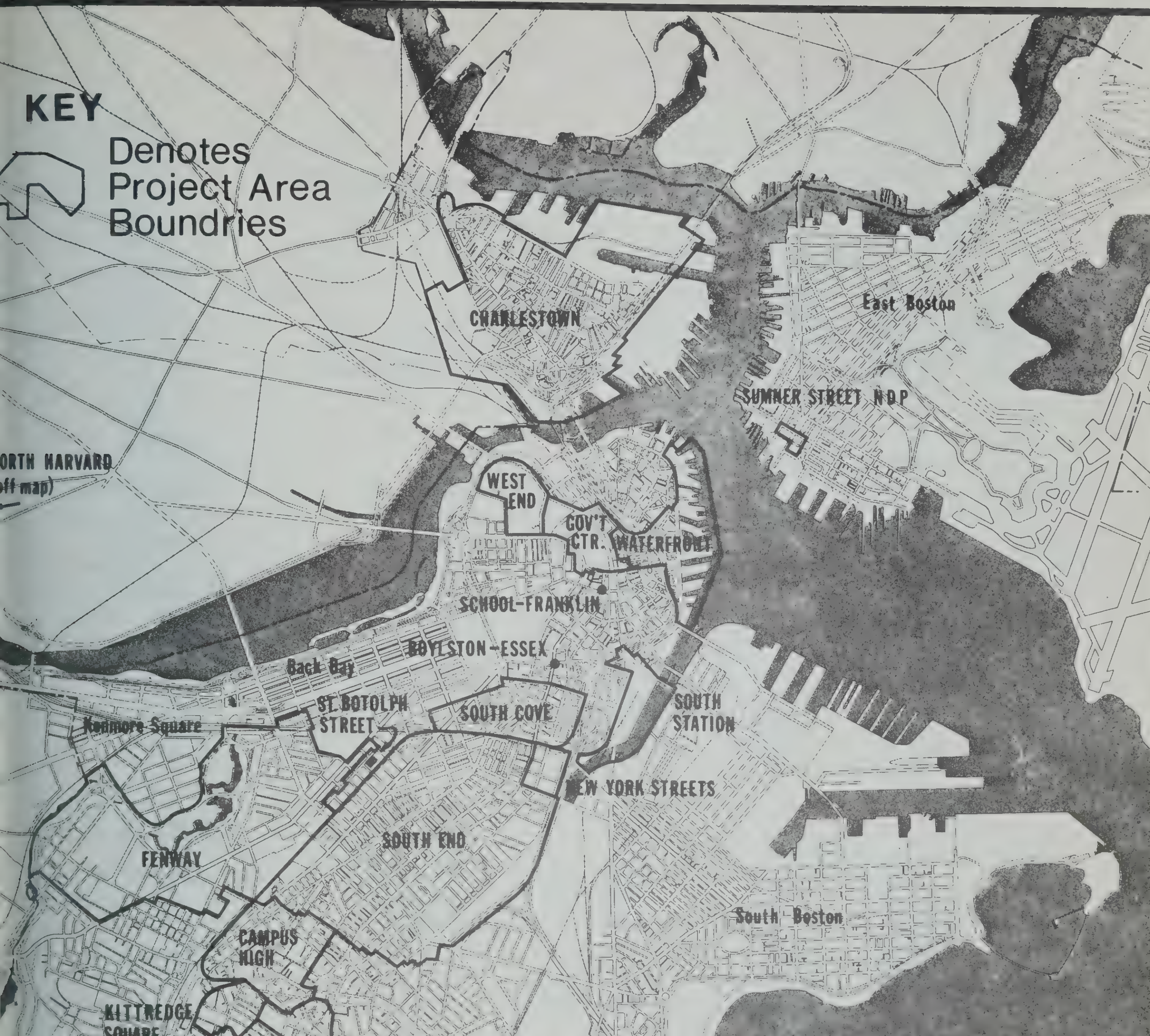

KEY
Denotes Project Area Boundries
CHARLESTOWN
East Boston
SUMNER STREET NDP
NORTH HARVARD (off map)
WEST END
GOV'T CTR.
WATERFRONT
SCHOOL-FRANKLIN
BOYLSTON-ESSEX
Back Bay
ST. BOTOLPH STREET
SOUTH COVE
SOUTH STATION
Kenmore Square
NEW YORK STREETS
SOUTH END
FENWAY
South Boston
CAMPUS HIGH
KITTREDGE SQUARE
Roxbury - North Dorchester
WASHINGTON PARK
BRUNSWICK-KING
FEDERALLY ASSISTED URBAN RENEWAL PROJECTS
BOSTON REDEVELOPMENT AUTHORITY
N

FIGURE
II-9

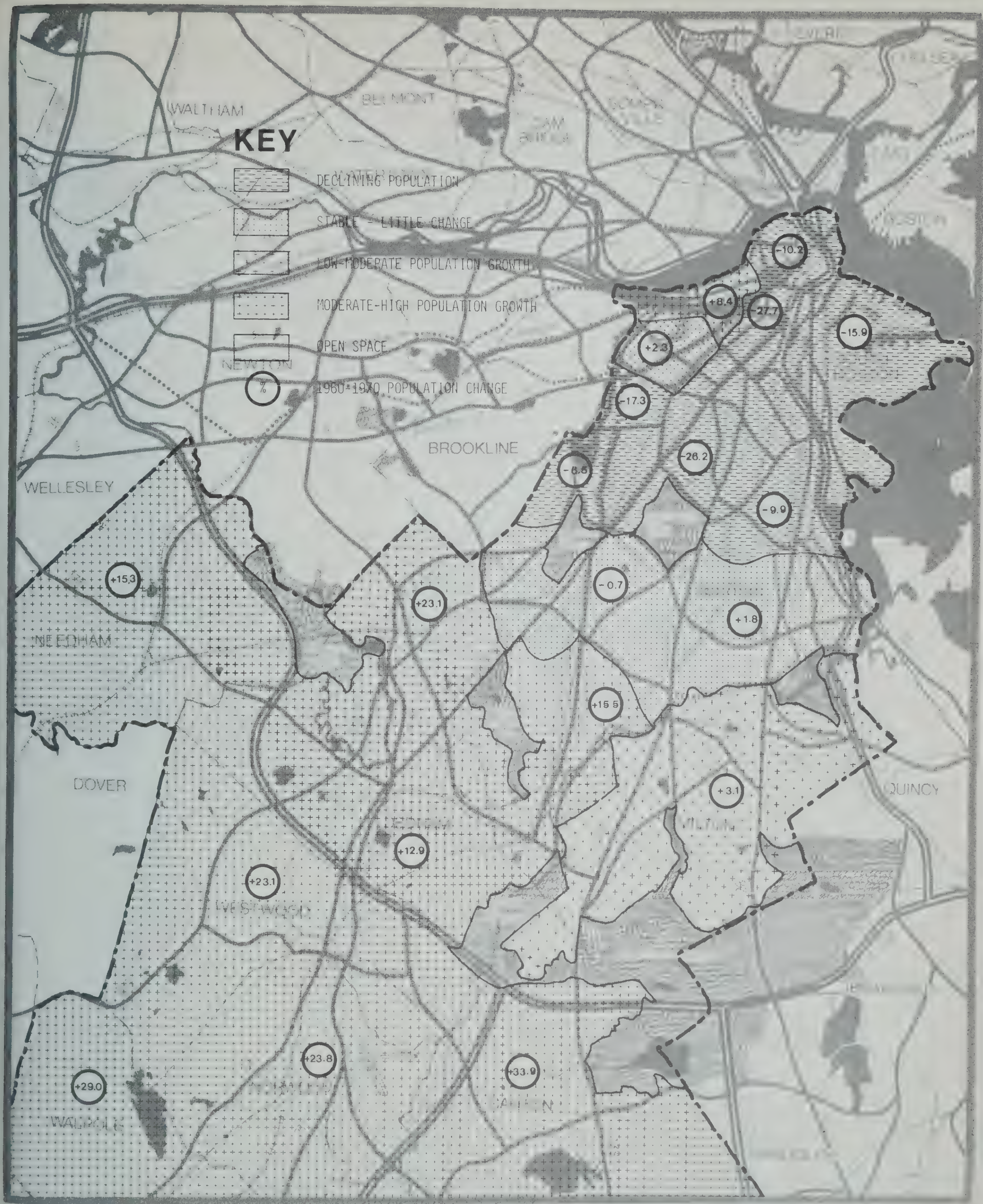
(FIG. II-10)

SOUTHWEST SUBREGION WITHIN BOSTON CITY LIMITS

Population Characteristics

	Population 1960	Population 1970	Percent Change 1960 - 1970	1970 - Percent Black	1970 - Percent Spanish Speaking
Inner City					
South End	30,059	21,726		46.6	8.6
Back Bay	47,869	51,912		9.1	1.0
Fenway	(23,014)	(23,551)		(14.8)	(2.2)
Roxbury	85,194	62,856		65.2	2.8
Mission Hill	(23,137)	(19,144)		(28.6)	(9.1)
South Boston	45,766	38,488		1.0	--
Jamaica Plain	35,372	33,060		4.1	4.4
North Dorchester	112,504	101,386		33.0	3.8
Subtotal	356,764	309,428	-13.3	29.4	5.1
Inner Suburbs					
Roslindale	40,363	40,070		1.8	--
South Dorchester	74,135	75,505		20.1	4.0
Hyde Park	33,123	38,264		1.4	.2
West Roxbury	25,328	31,190		.3	--
Subtotal	172,949	185,029	+ 7.0	8.9	1.6
TOTAL	529,713	494,457	- 6.7	21.7	2.5

Source: BTPR



1960–1970 GROWTH POPULATION & DECLINE

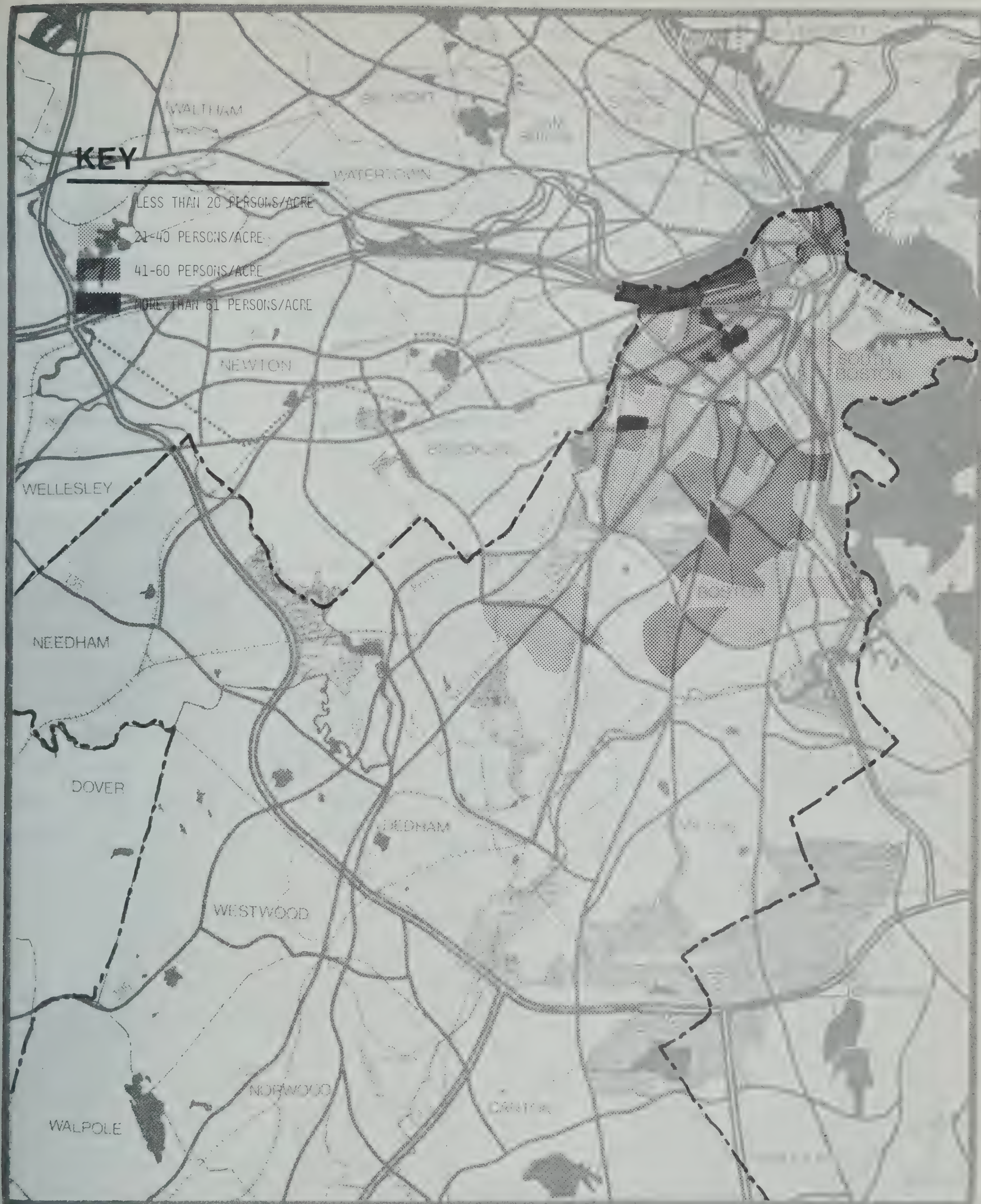
SOURCE BTPR

NORTH

SCALE

0 1 2 3 4 MILES

FIGURE II-10a



1970 SOUTHWEST POPULATION DENSITY

SOURCE BTPR

SCALE

0 1 2 3 4 MILES

NORTH

FIGURE II-10b

(FIG. II-11)

SOUTHWEST CORRIDOR HOUSING CHARACTERISTICS

	1960 Housing Units	1970 Housing Units	Percent Change 1960-1970	Percent Multi-Fam. 1970	Percent Renter Occupied 1970
(Boston)	(238,545)	(232,413)	(-2.6)	(89.9)	(68.2)
Inner City					
Central Area	14,797	14,847	+ .3	96.6	75.2
South End	18,264	10,358	-43.3	92.1	74.3
Back Bay	22,327	23,136	+ 3.6	98.3	89.6
Fenway	(11,389)	(10,842)	(- 4.8)	(91.1)	(91.0)
Roxbury	29,400	23,356	-20.6	90.0	74.7
Mission Hill	(7,092)	(7,357)	(+ 3.7)	(95.5)	(80.5)
South Boston	14,575	14,259	- 2.2	86.3	69.5
Jamaica Plain	10,969	11,155	+ 1.7	83.5	65.9
North Dorchester	34,145	32,525	- 4.7	91.1	66.7
Subtotal	144,475	129,636	-10.2	91.7	74.1
Inner Suburbs					
Roslindale	10,831	12,307	+13.6	66.6	48.6
South Dorchester	22,072	24,599	+11.4	81.5	59.1
Hyde Park	9,292	11,880	+27.8	49.9	43.1
West Roxbury	7,365	9,827	+33.4	41.7	33.6
Subtotal	49,560	58,613	+18.2	65.3	49.4

Source: BTPR

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

PROJECT AREA

MAJOR HOUSING LOCATIONS

LEGEND

- ● HOUSING DEVELOPMENT 1960-1969
- ■ HOUSING DEVELOPMENT 1970-1976
- ▲ EXISTING PUBLIC HOUSING

SCALE

0 1200 2400 3600

NORTH

FIGURE II-11a

(FIG. II-12)

EMPLOYMENT BY INDUSTRY DIVISION, BOSTON SMSA

Industry Division	Number of Employees (Thousands)			
	1967 (1)	1971 (1)	1974 (1)	Nov. 1975 (2)
Construction	50.2	58.5	54.6	51.3
Manufacturing	305.0	271.1	274.1	260.7
Transportation, Communications & Public Utilities	70.0	74.6	74.2	69.4
Trade, Wholesale & Retail	275.7	299.8	302.9	311.0
Finance, Insurance & Real Estate	84.4	95.1	98.7	100.0
Service, Misc. & Mining	278.9	286.3	319.2	337.4
Government	166.3	191.2	188.7	193.3
	1,230.5	1,276.6	1,312.1	1,323.1

Source: Massachusetts Division of Employment Security, Research and Statistics.

[1] Average annual employment

[2] Monthly employment

(FIG. II-13)

1960-1970 Occupational Characteristics by Community

SOUTHWEST SUBREGION WITHIN BOSTON CITY LIMITS

	PROFESSIONAL, TECHNICAL, MANAGERS, ETC.		CRAFTSMEN, FOREMEN		CLERICAL - SALES		OPERATORS		SERVICE, HOUSEHOLD AND LABORERS		TOTAL	
	1970	% change 1960-1970	1970	% change 1960-1970	1970	% change 1960-1970	1970	% Change 1960-1970	1970	% change 1960-1970	1970	% change 1960-1970
Inner City												
South End	1,797	+21	725	-39	2,092	+14	1,598	-42	1,920	-61	8,132	-33
Back Bay	11,506	+33	946	-14	9,989	+25	1,222	-18	4,900	+33	28,563	+25
Fenway	(3,805)	(+13)	(466)	(+17)	(4,136)	(+19)	(623)	(-35)	(2,365)	(-29)	(11,395)	(+12)
Roxbury	4,212	+13	1,880	-36	5,519	+ 6	3,713	-53	5,797	-22	21,121	-22
Mission Hill	(2,076)	(+36)	(520)	(-28)	(1,962)	(- 5)	(704)	(-45)	(2,296)	(+25)	(9,528)	(+28)
South Boston	1,787	+15	1,748	-15	4,948	+16	2,435	-37	3,509	- 2	14,427	- 6
Jamaica Plain	1,989	-31	1,293	-24	3,098	-24	1,584	-39	2,493	+10	10,457	-23
North Dorchester	4,601	- 9	4,767	-22	10,841	-13	7,082	-25	8,543	+11	35,834	-12
Subtotal	25,892	+11	11,359	-25	36,487	+ 2	17,634	-37	27,162	- 8	118,534	-10
Inner Suburbs												
Roslindale	3,349	+ 5	2,126	- 6	5,613	+12	2,170	- 4	3,359	+37	16,617	+ 9
South Dorchester	5,523	+ 5	3,674	-11	10,920	+ 1	4,495	- 3	5,776	+52	30,388	+ 6
Hyde Park	3,247	+38	2,223	-46	5,507	+73	2,181	- 3	2,933	+50	16,091	+16
West Roxbury	4,029	+25	1,351	+14	4,887	+28	1,023	- 5	2,026	+55	13,316	+26
Subtotal	16,148	+15	9,374	-20	26,927	+18	9,869	- 3	14,094	+48	76,412	+12
TOTAL	42,040	+12	20,733	-23	63,414	+ 8	27,503	-28	41,256	+ 6	194,946	- 3

Source: 1970 Census Data. Those not reported, not included

(FIG. II-14)

INCOME CHARACTERISTICS*

	Individuals:			Families:		
	Below Poverty (1)	Total	Per-cent	Below Poverty (1)	Total	Per-cent
(BOSTON)*	(33,720)	(109,811)	(31)	(16,600	(142,019)	(12)
Inner City						
Central Area	2,669	11,471	23	473	5,310	9
South End	3,170	8,855	35	790	3,629	22
Back Bay	8,086	39,474	21	536	4,938	11
Fenway	(3,793)	(17,207)	(22)	(361)	(2,442)	(15)
Roxbury	3,597	10,314	35	3,102	13,825	22
Mission Hill	(1,907)	(4,960)	(38)	(857)	(3,820)	(22)
South Boston	1,600	5,210	31	1,230	9,115	14
Jamaica Plain	1,046	4,284	24	769	7,925	10
No. Dorchester	2,579	8,492	30	4,133	23,605	18
Subtotal	22,747	88,100	26	11,033	68,347	16
Inner Suburbs						
Roslindale	702	2,670	26	517	9,994	5
South Dorchester	1,781	6,287	28	1,744	18,983	9
Hyde Park	692	2,336	30	518	9,653	5
West Roxbury	513	2,209	23	273	8,025	3
Subtotal	3,688	13,502	27	3,052	46,655	7
Outer Suburbs						
Canton	160	665	24	96	4,088	2
Dedham	415	1,424	29	251	6,656	4
Foxborough	190	653	29	95	3,267	3
Milton	473	1,678	28	135	6,825	2
Needham	301	1,263	24	183	7,583	2
Norwood	462	1,877	25	238	7,540	3
Sharon	71	308	23	103	3,092	3
Walpole	133	737	18	123	4,178	3
Westwood	69	359	19	74	3,238	2
Subtotal	2,274	8,964	25	1,298	46,467	3
Total	28,709	110,566	26	15,383	161,469	10

*This chart compares City totals for Individuals and Families in all Boston Neighborhoods

(1) Source: U.S. Bureau of Census, Money Income and Status of Families and Persons in the U.S. - 1974 (P. 60 Series, No. 99, July 1975). Weighted average poverty threshold for an individual in 1974 was $2,495/year and for a family of four was $5,038/year.

(FIG. II-15)

1970 DISTRIBUTION OF FAMILY INCOME BY ETHNIC GROUPS - SOUTH END

	All Families	White	Other	Black	Hispanic
Under $5,000	1574(40%)	284(24%)	226(37%)	851(41%)	213(62%)
$5,000-$10,000	1376(35%)	368(31%)	231(38%)	665(36%)	112(33%)
$10,000 plus	1002(25%)	534(45%)	148(25%)	303(17%)	17(5%)
Total	3952	1186	605	1819	342
Median Income	$6,426	$9,212	$6,666	$5,312	$4,038

40% of all families had incomes below $5,000 in 1970.

Source: 1970 Census Data

(FIG. II-16)

PERCENT OF UNEMPLOYMENT

	Percent Unemployment		Percent Change	
	1970 [1]	1975 [2]	1970	1975
Boston	4.5	14.1		
Inner City				
South End	7.2	17.9	149	
Back Bay	3.9	7.6	95	
Roxbury	6.1	16.7	174	
South Boston	5.0	15.6	212	
Jamaica Plain	4.3	17.0	295	
North Dorchester	4.8	14.0	192	
Inner Suburbs				
Roslindale	3.6	14.4	300	
South Boston	3.5	15.1	331	
Hyde Park	3.5	15.8	351	
West Roxbury	2.7	11.7	333	

Source: [1] Massachusetts Division of Employment Security (MDES); and U.S. Census

[2] MDES mid 1975 Special Survey

NOTE

It should be noted that the 1975 rate and hence the percent change, should be viewed as indicators only. As discussed in the Review, the actual number of persons unemployed is larger than that projected from the Study. The 1970 U.S. Census ratios were utilized, which may not hold true today.

(FIG. II-17)

UNEMPLOYMENT RATE TRENDS

IN THE

UNITED STATES, MASSACHUSETTS AND BOSTON SMSA*

Period	United States	Massachusetts	Boston SMSA
1970	4.9	4.6	4.0
1971	5.9	6.6	5.7
1972	5.6	6.4	6.5
1973	4.9	6.7	6.8
1974	5.6	7.2	7.2
1975			
January	9.0	10.3	9.2
February	9.1	11.9	10.8
March	9.1	12.5	11.4
April	8.6	12.2	11.1
May	8.3	12.6	11.6

Source: Massachusetts Division of Employment Security

*Standard Metropolitan Statistical Area (Includes 17 Cities and 61 Towns)

(FIG. II-18)

SOUTHWEST SUBREGION WITHIN BOSTON CITY LIMITS

PERCENT OF UNEMPLOYMENT BY RACE AND SEX

	Inner City						Inner Suburbs			
	South End	Back Bay	Roxbury	South Boston	Jamaica Plain	N. Dorchester	Roslindale	S. Dorchester	Hyde Park	W. Roxbury
W. Males	15	47	13	60	36	42	41	22	49	40
W. Females	10	22	4	38	25	22	33	12	35	39
Blk Males	23	10	45	0	12	11	0	30	2	1
Blk Females	12	3	19	0	7	5	1	16	1	1
Oriental Males	5	1	0	0	0	0	0	0	0	1
Oriental Females	15	3	0	0	0	0	0	0	0	0
Spanish Males	7	0	5	0	2	0	1	0	0	0
Spanish Females	1	0	4	0	2	0	1	0	1	0
Race INA* Males	24	8	8	1	9	11	11	13	6	11
Race INA* Females	4	6	2	1	7	9	12	7	6	8
	100	100	100	100	100	100	100	100	100	100

Source: MDES mid 1975 Special Survey

* Information not available

(FIG. II-19)

PERCENT OF UNEMPLOYMENT BY AGE GROUPS

	16-19	20-25	26-45	46-64	65+
Inner City					
South End	0	12	52	26	10
Back Bay	1	19	46	19	15
Roxbury	2	24	46	21	7
South Boston	3	16	28	32	21
Jamaica Plain	2	21	36	21	20
North Dorchester	2	19	36	25	18
Subtotal	2	20	40	24	14
Inner Suburbs					
Roslindale	1	16	28	25	29
South Dorchester	2	22	44	18	14
Hyde Park	1	18	21	32	28
West Roxbury	2	10	25	27	36
Subtotal	2	18	34	23	23
Total	2	19	38	23	18

Source: MDES mid 1975 Special Survey

(FIG. II-20)

FEDERAL AND MASSACHUSETTS AIR QUALITY STANDARDS

Contaminant	Averaging Time	Concentration Primary $\mu g/m^3$	Std. ppm	Sec. $\mu g/m^3$	Std. ppm.	Measurement Criteria[1]
Sulfur Oxides (SO_2)	Year	80	0.03	-	-	Arithmetic Mean
	Day	365	0.14	-	-	Maximum
	3 Hours	-	-	1,300	0.5	Maximum
Total Suspended Particulates (TSP)	Year	75	-	60[2]	-	Geometric Mean
	Day	260	-	150	-	Maximum
Carbon Monoxide (CO)	8 Hours	10,000	9	10,000	9	Maximum
	1 Hour	40,000	35	40,000	35	Maximum
Photochemical Oxidants (O_3)	1 Hour	160	0.08	150	0.08	Maximum
Hydrocarbons (Non-Methane)	3 Hours	160[3]	0.24	160	0.24	Maximum between 6 am and 9 am
Nitrogen Oxides (NO_2)	Year	100	0.05	100	0.05	Arithmetic Mean

[1] Standards other than those based on annual arithmetic or geometric mean are not to be exceeded more than once per year.

[2] For use as a guide in assessing implementation plans to achieve the 24-hour TSP standard.

[3] For use as a guide in devising implementation plans to achieve the oxident standard.

(FIG. II-21)

TYPICAL NOISE LEVELS

Outdoor Noise Levels	NOISE LEVEL (dBA)	Indoor Noise Levels
	110	Rock Band (L_{eq})*
Jet Flyover at 1000 ft		
	100	
		Newspaper Press
Gas Lawn Mower at 3 ft		
Diesel Truck at 50 ft	90	Food Blender at 3 ft
Noisy Urban Daytime (L_{eq})	80	Garbage Disposal at 3 ft Shouting at 3 ft.
Gas Lawn Mower at 100 ft	70	Vacuum Cleaner at 10 ft Normal Speech at 3 ft
Quiet Urban Daytime (L_{eq})	60	
		Large Business Office
Quiet Urban Nighttime (L_{eq})	50	Dishwasher Next Room
Quiet Suburban Nighttime (L_{eq})		
	40	Small Theatre, Large Conference Room (Background)
Quiet Rural Nighttime (L_{eq})		Library
	30	
		Bedroom at Nighttime Concert Hall (Background)
	20	Broadcast and Recording Studio
	10	
		Threshold of Hearing
	0	

*L_{eq} see Fig. II-22

(FIG. II-22)

MEASURES OF ENVIRONMENTAL NOISE

Noise Measure	Description	Use
L_{max}	The maximum A-Weighted noise level occurring during an identifiable intrusive noise event.	Characterizes a single noise (truck, airplane, transit car).
L_{eq}	The equivalent sound level, or the steady noise level that would convey the same noise energy as the actual time varying noise at a site in the same time period.	Accepted by the FHWA for predicting and assessing highway noise impact.
L_{dn}	The day-night sound level: the 24 hour equivalent sound level with a 10dB penalty applied to noise levels during the 9 nighttime hours from 2200 to 0700.	Used in community noise assessments; proposed by U.S. EPA for use in environmental noise studies.

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

SITE MAP
NOISE MONITORING

LEGEND

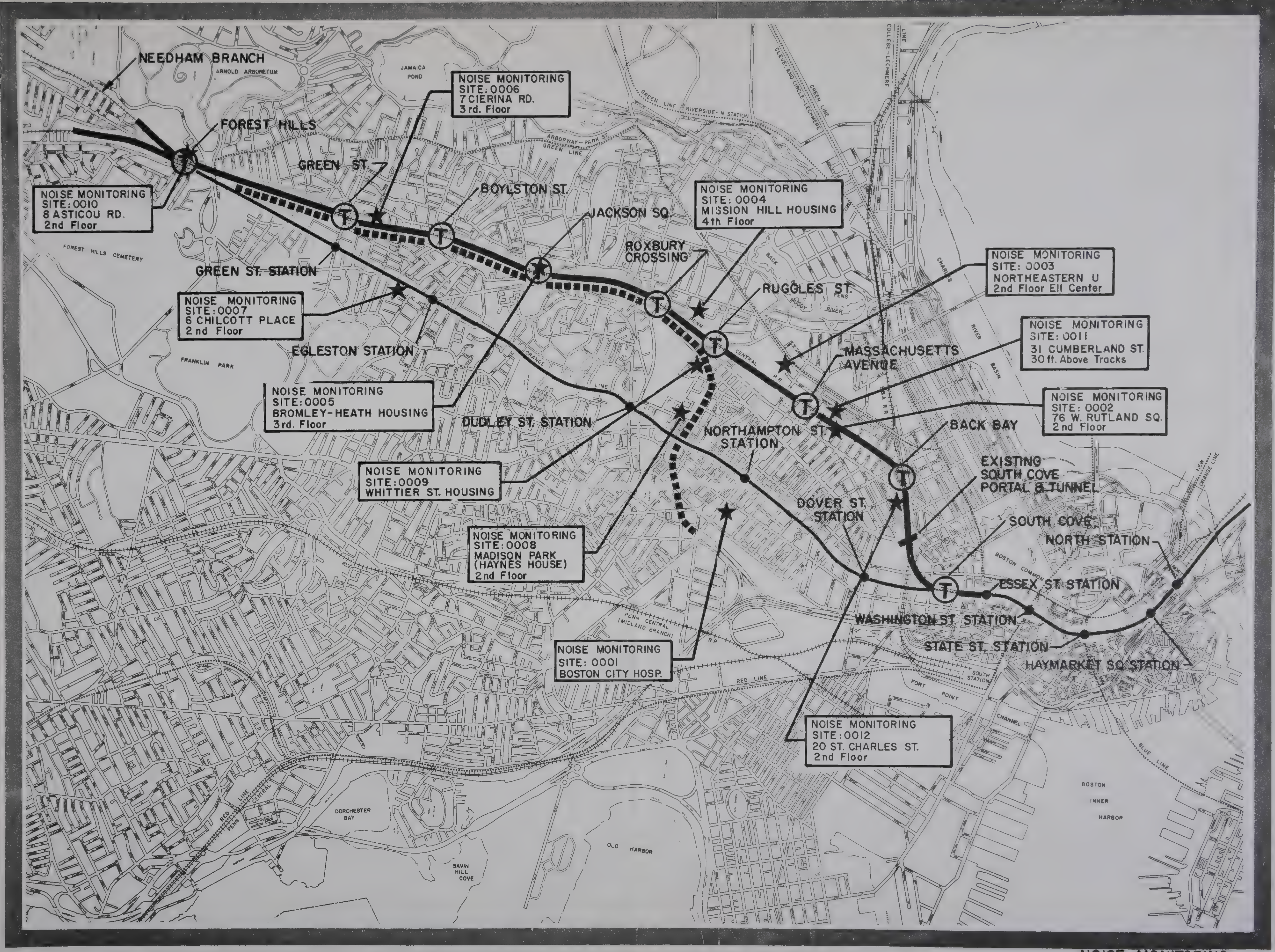
★ NOISE MONITORING SITE

NORTH

SCALE

0 1200 2400 3600

FIGURE
II-23



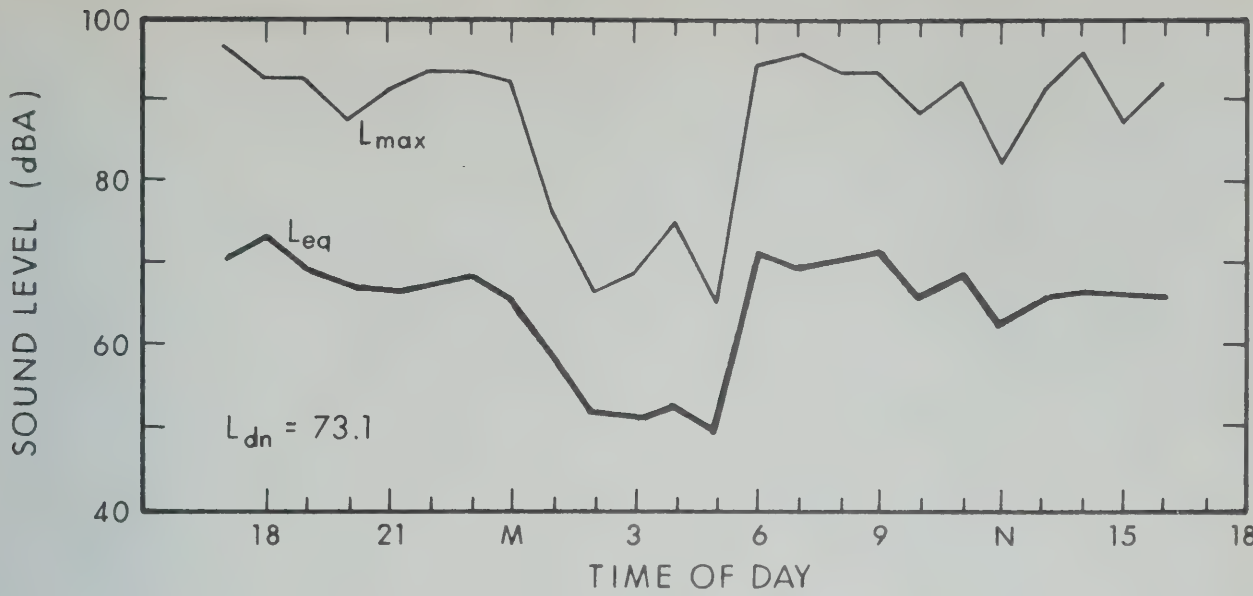
(FIG. II-24)

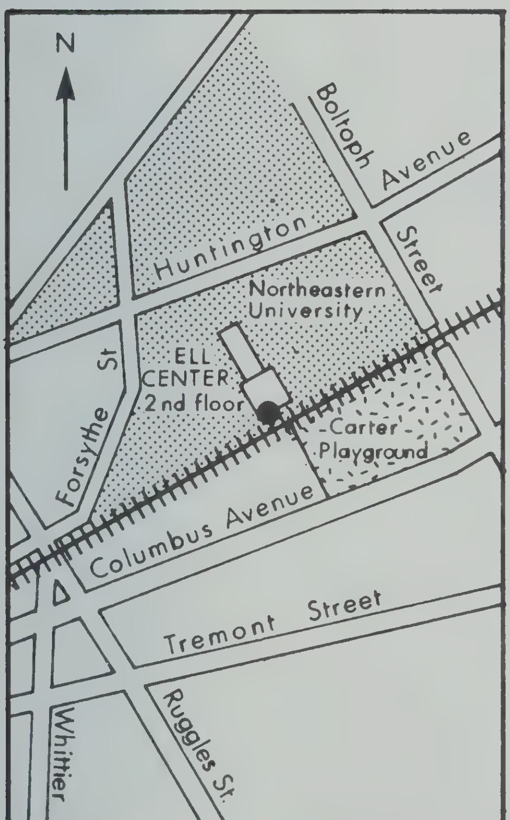
SUMMARY OF MEASURED A-WEIGHTED SOUND LEVELS

POSITION	L_{dn}	L_{max} DAYTIME/NIGHTTIME LEVEL*	L_{eq} DAYTIME/NIGHTTIME LEVEL*	MAJOR NOISE SOURCE
1. Boston City Hospital	80	106/101	77/71	Mass. Ave. Traffic, Construction
2. 76 W. Rutland Square	70	96/90	70/61	Trains, Columbus Avenue Traffic
3. Northeastern Univ. (Carter Playgrnd)	73	96/96	69/66	Trains
4. Mission Hill Housing	74	99/99	72/67	Trains, Columbus Avenue Traffic
5. Bromley-Heath Housing	76	105/98	74/68	Trains, Local Traffic
6. 7 Cerina Road (near Green St. Playground)	70	95/94	68/62	Trains
7. 6 Chilcot Place	78	98/95	77/69	MBTA Orange Line, Wash. St. Traffic
8. Madison Park (Haynes House)	64	95/98	63/54	Shawmut Avenue Traffic
9. Whittier St. Housing	76	103/100	74/68	Tremont St. and Columbus Avenue Traffic
10. Asticou Road	68	100/91	66/60	Trains, Washington Street Traffic
11. 31 Cumberland Street	80	110+/110+**	78/73	Trains
12. 20 St. Charles Street	80	104/98	77/72	Mass. Turnpike Traffic, Trains

* Daytime = 7AM to 10PM / Nighttime = 10PM to 7AM.

**Peak Noise levels at this site overloaded the recording instrument at 110dBA.





Not to Scale

SITE NO: 0003

LOCATION:
Ell Center, Northeastern University (near Carter Playground)

MICROPHONE HEIGHT:
2nd Floor

MAJOR NOISE SOURCE:
Trains

OTHER NOISE SOURCES:
Columbus Ave. Traffic

TIME OF MEASUREMENT:
4PM 9/29/75 to
4PM 9/30/75

	DAY	NIGHT	24 hr.
Peak	96	96	96
L_{eq}	69	66	68

NOISE MEASUREMENTS NORTHEASTERN UNIVERSITY — CARTER PLAYGROUND

FIGURE

II-25

CHAPTER THREE:
TRANSPORTATION IN THE STUDY AREA

3.0 TRANSPORTATION IN THE STUDY AREA

The characteristics of use and operation of transportation facilities in the study area have been examined and evaluated to assist in planning the proposed project. The findings of this work are presented in summary form in the following paragraphs.

3.1 The Transportation System

The study area is served by a system of rapid transit facilities, a number of MBTA and privately operated bus routes, and surface streets and highways for private travel. These facilities are shown on Fig. III-1. Also passing through the study area is a major rail facility serving Southwest commuters and intercity rail passengers.

3.1.1 Rapid Transit Facilities

Within the corridor, the elevated Orange Line provides rapid-transit service. The southern half of the line extends approximately 4.7 miles from Washington Station in downtown Boston to Forest Hills and has 7 stations, averaging 0.7 miles between stops. Trips from downtown to Forest Hills presently takes 16 minutes, achieving an average speed of 18 miles per hour. The elevated steel structure is antiquated, and noisy, and the line is considered to have a blighting effect on Washington Street, which it follows for its entire length.

Outside the Southwest Corridor, the Red Line Rapid-Transit provides service to Quincy and other portions of the South Shore, as well as to the Ashmont and Mattapan sections of the City of Boston. Even though it lies outside the Corridor, the Red Line provides a limited amount of service to the Southwest by means of buses acting as feeders as well as the light rail shuttle between Ashmont and Mattapan.

The present Light Rail service in the Corridor consists of: the Green Line Arborway service and the Ashmont-Mattapan shuttle. The Arborway Line is routed along Huntington Avenue from the subway portal south of Massachusetts Avenue to South Huntington Avenue. At Massachusetts Avenue, the Penn Central tracks are about 600 feet easterly. By following Huntington Avenue and South Huntington Avenue, the line swings widely through Jamaica Plain and its Centre Street commercial focus to terminate in the MBTA yard on Washington Street near the Forest Hills Orange Line station. Between the subway portal on Huntington Avenue and the Forest Hills terminal, it is an in-street operation subject to traffic interferences and weather conditions. It is, nevertheless, considered by many Jamaica Plain residents to be essential for access to the Fenway and Back Bay areas which are not now served by the Orange Line.

Current fares on all rapid transit lines in the study area are 25 cents, except for the Arborway Line which has an additional 25 cent surcharge for its surface operations. The light rail facility between Ashmont and Mattapan is treated as an integral part of the Red Line and may be ridden locally or with a change at Ashmont to downtown for the single fare of 25 cents.

3.1.2 Commuter Rail and AMTRAK Services

Four commuter rail routes are now operated to Back Bay and South Stations through the corridor. These routes originate in Needham, Franklin, Providence and Stoughton. The Needham branch serves eight stations between Needham Heights and Forest Hills. The Franklin branch services ten stations between Franklin and Readville (Hyde Park). The Providence service is the Penn Central main line to New York and includes service from Rhode Island and several other communities en route to Boston. The Stoughton Branch consists of only two stations. The Franklin, Providence and Stoughton services join south of Readville and travel

the Penn Central main line to Forest Hills, where they are joined by the Needham branch. Only a few of these services stop for passenger boarding or alightment at Forest Hills. Between Forest Hills and downtown all services are on the Penn Central main line tracks and embankment.

AMTRAK services are provided on the Penn Central main line tracks between Washington, New York, Providence and Boston. These services also pass through Forest Hills, en route to Back Bay or South Station in downtown Boston. All of the services pass through the Corridor and stop at Back Bay Station. Coordination with transit services at Back Bay station is, therefore, important for downtown distribution.

3.1.3 Bus System

An extensive network of surface bus routes serves the Southwest area of the Boston and adjacent communities. Fig. III-2 illustrates the routing of the MBTA buses which serve the study area. Several of the lines which serve the outer suburbs may be boarded at the Forest Hills station.

The MBTA bus network in the study area is focused heavily on the existing rapid transit line. Bus-rail transfers are particularly heavy at certain existing Orange Line stations such as Dudley, Egleston and Forest Hills. Bus routes and schedules have, therefore, been closely coordinated with rapid transit services. Because of the minimal commuter rail service at Forest Hills station, no coordination has been made between these services and bus schedules.

In general MBTA buses are operated from 6 a.m. until 1 a.m. at night. Midday frequencies range from 12 to 30 minutes on MBTA routes, with more frequent services on all routes in peak hours. A few routes provide only peak period service. Certain streets in the Southwest Corridor are notable for the frequency of bus service each is provided. These include Washington Street in Roslindale, and Warren Avenue approaching Dudley Square. Both of these routes have services closely linked to rapid transit access points. (See Fig. II-2A)

As of January 1976, the basic MBTA bus fare is 25 cent, with no transfer privileges. Transfer between buses and rapid transit means a full additional fare.

3.1.4 Streets and Highways

Within the study area there is a very limited system of arterial streets. The only street that traverses the entire Corridor continuously from the CBD to Forest Hills is Washington Street. However, this street has limited capacity as an arterial street because of the restricted width, the overhead transit structure, and parking interferences caused by the commercial development throughout much of its length.

The two most important north-south arterial streets in the Corridor (from a traffic volume standpoint) are Tremont Street and Columbus Avenue. Both of these streets lack continuity. Tremont Street begins in the CBD and extends less than one half of the distance to Forest Hills where it turns westerly and terminates in the Mission Hill section of Roxbury. Columbus Avenue also begins in the CBD and generally parallels Tremont Street to the point where the two arteries cross at Roxbury Crossing. Columbus Avenue continues to Jackson Square, about one-half mile further south, and then turns easterly to terminate at its connection with Seaver Street.

The only continuous east-west arterial street crossing the Corridor is Massachusetts Avenue. While this is a very important street, it is located near the outer fringe of the Central Business District. This location, along with the heavy residential/commercial development, makes it incapable of serving all east-west traffic needs of the entire Corridor.

Other important streets in the Corridor include Centre, Amory, Lamartine, Dudley, Ruggles, and Green Streets. Because of the irregular configuration of the street system in the Corridor, there are several focal points where several of the more important streets converge.

Some of the more important focal points include Forest Hills, Jackson Square, Roxbury Crossing, Dudley Square, and Egleston station. Forest Hills, Egleston station and Dudley Square are presently important transit transfer locations as well as being focal points with respect to arterial streets.

3.2 Existing Transit Usage

3.2.1 Rapid Transit Ridership

Fig. III-3 shows the ridership trends of the existing Orange Line and the Arborway Line in the Southwest Corridor. These statistics, compiled each year in the first week of December, represent boardings only, and should not be considered as average daily traffic. They are useful in ascertaining trends of ridership, however, and indicate that ridership over the past few years has been declining on the present Orange Line. Similar tabulations for the Red Line, by comparison, indicate a stable or growing ridership on both the Cambridge and South Shore portions of the line. Other lines have been declining in ridership, but not at the relatively rapid rate which has been experienced on the Orange Line.

The ridership decline on the Orange Line can only be explained in part. The line is perceived by many persons as being in poor physical condition, dirty and dangerous. Major structural repairs have been completed and painting of the structure is underway but station modernization has only begun. The fear of crime on the line or in areas through which the line passes may contribute to the declining ridership. In addition, the decline in the building of housing units over the past 20 years as well as the demolition of many housing units along with a decline in the proportion of workers within the population living in the Corridor, have adversely affected transit use.

Since there are alternative transit routes into downtown, some of the ridership may be diverted to those lines. For example, the Arborway Line (Green Line) has had substantially increased ridership in the past five years (Fig. III-3); these increases may be due in part to riders diverted from the Orange Line. Similarly, newly extended bus service from Egleston Square to downtown may be diverting traffic from the Orange Line - particularly the Lower Roxbury and South End areas. The extent of such diversions is, of course, speculative, but does assist in explaining the recent declines in Orange Line ridership. It should be noted that the drop in ridership counts between 1960 and 1961, reflects a change in counting methods at certain stations with feeder bus connections.

3.2.2 Commuter Rail Line Volumes

The Southwest Corridor, inside the City of Boston, is only partially served by commuter rail lines. Passengers boarding the the Needham, Franklin, Providence and Stoughton branches are shown in Fig. III-4. Statistics shown in this table indicates total line ridership and includes the stations within the City; namely, West Roxbury, Highland Avenue, Bellevue Avenue, Roslindale Square, Readville, Hyde Park and Mount Hope. Only a few of the trains stop at Forest Hills. Boardings are minimal because of the adjacent rapid transit station and because commuter rail fares are significantly higher than rapid transit fares.

Nearly 4,420 passengers are carried on the commuter rail lines passing through the Corridor daily, en route to either Back Bay Station or South Station. These volumes are being gradually increased by fare adjustments, improved roadbed and improved frequencies. As the commuter rail improvement program progresses, the Franklin Branch roadbed will be virtually rebuilt, and additional trains will be provided to upgrade the level of service. Improvements on other branches will follow.

3.2.3 Special Mobility

The Southwest Corridor is characterized by the large percentage of its population dependent on public transportation. However, much of the Corridor is perceived by area residents as being inadequately served by presently available public transportation, including bus, rapid transit, commuter rail, chartered vehicles, or taxicabs. This problem stems from several sources: incomplete geographic coverage by MBTA bus routes in a few areas; insufficient frequency of bus service; unavailability of taxis in major segments of the Corridor; lack of local resources to charter vehicles on a regular basis; and excessive transferring or walking, particularly for crosstown movements. The importance of this description is to underscore the continued transit dependence of residents of the Southwest Corridor.

The problems are accentuated for transit dependent individuals because all or most of their travel must be made on public transportation vehicles. Off-peak/non-work trips are most difficult because of their dispersion timewise and geographically, but such trips may constitute the bulk of travel demand by the transit-dependent population. Coupled with the difficulty of delivering needed services in the Southwest Corridor -- particularly the inner city portion -- are the unique problems brought about by the large proportion of the population which is especially disadvantaged. These people include the elderly, the young, the handicapped, and the poor. The transportation needs of these residents, as determined by BTPR, are substantial in the Southwest Corridor. The groups requiring special mobility services include:

> The elderly. . . (100,000 are age 65 and over in the Southwest Corridor) who have physical difficulties using public transit. Their mobility is limited by poor transit service for shopping, health care or social services, and social-recreation trips.
>
> The young. . . (114,000 are between age 10 and 17 in the Southwest Corridor) who are dependent on transit to reach school and recreation areas.
>
> The handicapped. . . (47,000 are disabled in the Southwest Corridor) are often unable to use the present transit to reach school and recreation areas.
>
> The poor. . . encompassing a large proportion of the above groups but also including substantial numbers of working people whose transit-dependence limits their mobility for work, shopping, and all other trips. Twenty-three percent, or 44,000 families, in the Southwest had incomes under $6,000, making car ownership an economic burden.

In recognition of the problems of these groups in the Southwest, a "Special Mobility Study" was carried out to determine the need for new systems of transportation to meet previously unmet or latent needs. A home interview survey was conducted in the Southwest inner city areas of the City of Boston. The home interview survey consisted of a one percent sample of a study area which included parts of the South End, Roxbury, North Dorchester, Jamaica Plain, and Mattapan and a 3.5 percent sample of an area in Roxbury and North Dorchester (see Fig. III-5). The area sampled was chosen by community groups because it

contained a large number of female headed households and Spanish-speaking persons as well as appearing to be especially deficient in transit services. The survey was designed to elicit information about present trip making patterns and latent transportation demand for work, day care, medical, education, recreation and shopping trips. Attitudes towards usage of different modes of transport were also sought.

Work trips -- The survey area had about 1.1 workers per household or approximately 80,000 total. There were three workers for every two households with incomes over $6,000 and two workers for every three households with incomes under $6,000. Since there were few two-car families in the area, these figures imply that workers in households with higher incomes have problems reaching work similar to poor families with no cars. Fig. III-6 shows the mode of access to work. Workers from poor families depend more on transit than those from non-poor families; nearly half of all workers use transit. Nearly one quarter of workers in poor families used the Orange Line to reach work.

Major work destinations for all workers were: downtown Boston (31 percent); Roxbury and North Dorchester (21 percent); the Fenway (6.5 percent); and Cambridge (6.5 percent). Fig. III-7 shows the distribution of work destinations. Survey data indicated the difficulty of making circumferential trips and the necessity of multiple transfers for trips to the Fenway, Back Bay and Cambridge areas.

Reverse commuting is clearly a problem solved most easily by households with an automobile. Of the 16 percent work trips which were along or beyond Route 128 or in the North Shore, 80 percent were by automobile.

Shopping, Medical and Recreation Trips -- A majority of low-income households and elderly shoppers either walk to stores or take transit. On the return trip, many shoppers use taxis because of the difficulty of managing packages on transit or while walking.

Sixteen percent of medical trips were to City Hospital. The majority of the remaining trips were to medical facilities in the Fenway area requiring difficult crosstown travel for about 35 percent of the families.

Recreation trips showed a substantial dependence on the private automobile. Two-thirds of the households surveyed used a car to reach parks or beaches as compared to one-fourth who used public transit. Nearly half of the households without cars relied on others with a car to drive them to recreation areas.

Latent Demand -- The survey provided a limited insight into latent demand not only through the obvious dependence of Survey Area residents on fixed route transit, but also through responses to questions about desired trip destinations that were inaccessible. Twelve percent of the households surveyed indicated there was a potential work place that they could not reach. Twenty-eight percent of the shoppers indicated a desire to shop in areas inaccessible by public transportation. Ten percent of the respondents had similar answers with respect to medical trips for their children. Seventeen percent of the families said they would like to go to a park or beach which is inaccessible by public transportation.

3.2.4 Problems of Public Transportation Service

Studies of transit user attitudes provides what may be a typical ranking of transit service problems:

- Reliability
- Frequency
- Speed
- Crowding
- The "sensory" or comfort attributes- sight, sound, smell, feel
- Availability of information

Also not ranked, but clearly an important problem area, is that of transit service coverage and linkage - the extent of nearby service availability, the destinations served, and the reasonableness of fares.

Attitudes of the non-user of public transportation must also be taken into consideration. The relationship of transit service to the neighborhoods through which it passes in terms of noise, pollution and support of commercial activity and development are also important.

Reliability -- Problems arising from breakdowns and irregularity of service are frequent at the present time. Bus services are seriously affected by traffic congestion as well as the previously named factors. From observation of conditions in the Southwest, it would appear that the most serious traffic problems arise from parking violations rather than excessive moving vehicle volumes. Double and even triple parking is prevalent.

Frequency -- Examples of existing service frequencies in the Southwest are listed in Fig. III-8. Figure III-8 indicates that peak-period frequencies are generally adequate to provide a good level of service. During the mid-day period, frequencies appear to be reasonable although waiting times, particularly if regularity of service is not maintained, will begin to deter transit riding. The indicated half-hourly evening service on bus routes given as typical examples cannot be considered favorable to transit utilization, although it must be assumed that demand for more frequent service is not now clear.

Speed -- Travel by private automobile must be the standard against which transit services are judged with respect to speed. Because of the walking and waiting associated with travel by transit, overall trip time can only rarely be the equal of that attainable by automobile, but grade-separated transit can often produce better running times than automobiles in congested traffic. Fig. III-9 lists estimated transit door-to-door travel and existing auto travel times to the Boston Core.

By restricting the examples of transit speed to CBD-destined trips only the most favorable examples for transit are shown. All the higher-speed transit facilities are radial, and the slowest average automobile speeds are generally those on radial routes to downtown Boston. Thus, an examination of non-radial or circumferential trips within the Corridor would show that there is a uniform wide-spread need for improvement if transit is to be made competitive with the automobile for non-core oriented travel.

Crowding -- At the present time, peak-hour overcrowding is a fault of the transit services. Aside from its direct unfavorable impact on riders, overcrowding has a serious secondary disadvantage in that unloading and loading are much slower than if a reasonable ratio of passengers per car is maintained. Stopped time delays not only increase running time, but also contribute to the irregularity of service.

Comfort -- Crowding is one facet of passenger discomfort. In addition, the appearance and cleanliness of transit equipment and stations is important. Noise levels also are a problem.

Availability of Information -- The MBTA has begun a service of more effective public information and marketing.

Transit Coverage and Linkage -- While most of the Corridor has some transit service within five minutes walk - at least at peak hours - the usefulness of a transit route is closely related to the potential destinations it services directly, since trips requiring transfers are generally somewhat circuitous, always more time-consuming, and usually more costly. It is not practicable to link all points in a transit network directly to all other points with no more than one convenient transfer to other significant destinations. In the Southwest, large portions of the area require double transfers to reach the Back Bay employment center and the Fenway hospital and educational institutions. The commuter rail territory also has limited downtown distribution.

3.3 Existing Traffic Characteristics

The arterial street system in the Southwest Corridor is illustrated in Fig. III-10. In addition, the signalized intersections are shown as well as an indication of the relative volumes on the arterial streets. This network of streets serves a major sector of the city with a consequent high demand for both radial and circumferential traffic movements. The lack of street continuity, the poor street alignment, the restricted width of the traveled way, the numerous marginal frictions caused by parking, loading and/or unloading, driveway access points, and intersection conflicts all contribute to a street system with an insufficient capacity to effectively serve the present demand.

3.3.1 Average Annual Daily Traffic

Average daily traffic volumes (1975) are shown in Fig. III-11 for the major streets in the study area. The section of Columbus Avenue between Roxbury Crossing and Jackson Square carries the highest volume of any street in the Corridor with approximately 36,400 vehicles daily. Other high volume streets and roadways include the Arborway (38,000), Jamaicaway (34,000), Columbus Avenue between Jackson Square and Washington Street (24,500), Massachusetts Avenue (24,500 to 27,000), Columbus Avenue north of Ruggles Street (16,500 to 18,400), and Tremont Street north of Ruggles Street (15,000 to 17,000).

Because of the lack of continuity of most of the arterial streets in the Corridor, motorists are forced to use circuitous routings to reach their destination. This type of routing adds to congestion in the area by increasing the number of turning movements at key intersections and increases the potential for accidents at these same locations. In general, however, the basic characteristic of arterial street travel in the Corridor is radial in relation to the Central Business District. Cross-town or circumferential traffic movements are of secondary importance but are very significant and poorly served by the existing street pattern. In an effort to obtain a better understanding of the travel patterns in the Jamaica Plain section of the study area, a limited origin/destination study was conducted as part of this impact analysis study.

3.3.2 Traffic Accidents

The reported traffic accident records for the years of 1972, 1973 and 1974, (from the Registry of Motor Vehicles) were analyzed to determine the high accident locations and accident frequencies. Fig. III-12 shows the reported traffic accident locations. The accident frequency is illustrated by the size of the circles at each location. The circles indicate the yearly average number of reported accidents during the 1972-1974 period.

The three intersections with the highest yearly average number of reported accidents are Massachusetts Avenue at the Southeast Expressway Ramps, Centre Street/Jamaicaway Circle, and the Ruggles Street/Columbus Avenue intersection with 30, 28 and 26 reported accidents respectively. Other intersections with a significant number of accidents reported include the other intersections on Massachusetts Avenue, the Ruggles Street/Huntington Avenue intersection, and several other isolated intersections as shown on Fig. III-12.

3.3.3 Origin/Destination Study

A limited origin/destination study was conducted in the Jamaice Plain section operating eleven license plate recording stations on the important arterial streets shown on Fig. III-13. Observations were made during the commuting hours of 7 to 10 AM and 3 to 6 PM. A sampling of nearly 4,400 motorists was selected from among nearly 25,000 recorded license plates and mailed questionnaires. A 24 percent response was obtained from this mailing. About 80 percent of the responses were complete and useful for tabulating.

Tabulation and Analysis

A total of 779 origin/destination questionnaires were tabulated by traffic zone of trip origin and trip destination. Travel patterns for each station were obtained by multiplying the number of responses received for each station on a traffic zone basis by the ratio of the total volume of traffic passing through the station in the direction being observed to the number of responses received for that station. For example, at station number one, a total of 2,138 vehicles were counted traveling in the inbound direction during the six hours of observation. Forty six questionnaire responses were received resulting in an expansion ratio of 46.5. Therefore, each questionnaire response at station number one was equivalent to 46.5 vehicle trips.

To identify the most significant travel patterns in the Jamaica Plain area, the traffic zones were grouped to represent important sections of the metropolitan area, the city, and the study area. The 12 areas resulting from this traffic zone grouping are shown on Fig. III-14 and are identified in the following list:

Area	Section of Metropolitan Area, City or Study Area
A	CBD, Beacon Hill, South Cove, South Boston and South End
B	Dorchester and a portion of Roxbury
C	Fenway, Mission Hill and Roxbury
D	Jamaica Plain north of Morton Street and the Arborway
E	Jamaica Plain south of Morton Street and the Arborway, West Roxbury, Hyde Park, and Roslindale.
F	Brookline
G	Cambridge and Somerville
H	The entire north shore area
I	The towns generally northwest of Boston including Brighton and Allston sections of Boston
J	The towns southwest of Route 128
K	Dedham and the towns generally south of Route 128
L	Milton, Quincy, and the towns generally southeast of Route 128 including all south shore towns and Cape Cod.

The section of the proposed arterial street between Forest Hills and Jackson Square is included within area D. To illustrate the travel patterns that would have an impact on this section of Jamaica Plain most clearly, desire line diagrams for areas E, K, and L are presented in Fig. III-15, III-16, and III-17 respectively.

It is significant to note that about 45 percent of the commuter travel from area E (Fig. III-15) is directed toward the central area (area A). An additional 21 percent is directed toward area C and another 17 percent toward area D. Each of these areas lie directly in the alignment of the proposed arterial street. This strong desire (83 percent) for travel northerly from area E through area D explains the travel that occurs on such streets as Washington, Amory, and Lamartine Streets.

The travel pattern from area K is substantially different from area E as shown by comparing Fig. III-16 with Fig. III-15. The two strongest travel desires from area K are directed toward areas C (23 percent) and D (22 percent). Area A represents only 18 percent of the travel desires from area K in contrast to the 45 percent from area E. Area K also exhibits a more diverse travel desire pattern with all of the 12 areas showing a travel attraction whereas area E showed travel attractions in only 6 of the 12 areas.

The importance of Jamaica Plain as a travel corridor applies to area K as well as to area E but with less intensity. About 68 percent of the travel desires from area K lie directly in line with Jamaica Plain compared to the 83 percent from area E.

The travel pattern of area L shows very little similarity to areas E or K. Three important movements from area L are perpendicular to the proposed arterial alignment with 20 percent of the trips destined for area F, 10 percent for area I, and another 7 percent for area G. Thus, 37 percent of the trips from area L logically use Morton Street and the Arborway as a crosstown route. Trip orientation between area L and areas C and D is also strong with 16 and 25 percent of the trips headed for these two areas respectively.

In summary, this limited origin/destination study confirms the conclusion that would be drawn from the traffic flow map. The major travel desire within the study area is a north-south orientation with a strong travel desire directed toward the Central Business District and slightly lesser travel desires for the Fenway, Back Bay, Roxbury, and Jamaica Plain areas of the city. There is also a substantial crosstown travel desire between the south shore communities and the areas west of Boston including principally Brookline, Cambridge and Newton.

3.3.4 Travel Speeds

The Southwest Corridor has few continuous radial routes into downtown Boston. The existing routes consist of combinations of arterial routes which are somewhat circuitous, but which have been analyzed for comparison with adjacent expressways. The principal arterial is comprised of the VFW Parkway, which leads into Jamaicaway and eventually to Storrow Drive. Fig. III-18 shows the comparison of this route with two routes in the Southeast Corridor - 3A/Morrisey Blvd/Dorchester Avenue, and Southeast Expressway - and two routes in the Western Corridor - Route 9 and the Massachusetts Turnpike.

A review of the changes in level of service to radial traffic in the Southwest since 1963 shows the following:

Mass. Pike construction has decongested the Route 9/Riverway/Park Drive/ Storrow Route. This is the only place in the region where volumes are down -- resulting in substantial off-peak travel time savings and slight peak hour savings.

The VFW Parkway/Jamaicaway/Storrow route has changed very little since 1964 but carries substantially greater volumes. Peak hour travel time (Leverett Circle to Route 128) has increased in the evening to approximately 48 minutes while morning peak and off-peak speeds have remained constant.

The Southeast Expressway has undergone substantial operational improvements since 1963, including the use of breakdown lanes as travel lanes, ramp restrictions, an exclusive bus lane and a high degree of surveillance and enforcement. Despite a volume increase, evening peak speeds have not substantially changed, and remain about 22-25 miles per hour while off-peak speeds have been improved to about 45 miles per hour.

With the exception of the Massachusetts Turnpike, the average peak hour speed ranged from 18 to 22 mph. The corresponding morning peak hour speeds are slightly higher since there is less non-work traffic in the flow. In each case a deterioration of 1 to 10 minutes in the total trip time has been experienced since 1963.

Off-peak travel, however, has not deteriorated and is more subject to driver variability. Off-peak speeds from 25 to 45 miles per hour are possible, the latter on the Massachusetts Turnpike.

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

STUDY AREA
EXISTING TRANSPORTATION SYSTEM

LEGEND

- EXISTING EXPRESSWAY
- EXISTING BUS ROUTES
- EXISTING RAIL
- EXISTING RAPID TRANSIT

SCALE
NORTH
0 1200 2400 3600

FIGURE III - 1

EXISTING TRANSPORTATION SYSTEM

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

STUDY AREA
EXISTING BUS SYSTEM

LEGEND

45 — EXISTING BUS ROUTES
● RED LINE STATIONS
■ GREEN LINE STATIONS

SCALE 0 1200 2400 3600

NORTH

FIGURE III-2

Ⓐ ORANGE LINE STATIONS

A. WASHINGTON
B. ESSEX
C. DOVER
D. NORTHAMPTON
E. DUDLEY
F. EGLESTON
G. GREEN
H. FOREST HILLS

LEGEND OF EXISTING BUS ROUTES

1. Harvard — Dudley
5. Broadway Sta. — Backbay
9. City Pt. — Bway. & Tremont
10. City Pt. — Dudley
11. Bay View — Kneeland
13. Savin Hill — N'Hampton
15. Kane Sq. — Dudley
16. Egleston & Franklin — Andrew
17. Fields Cnr. — Andrew
19. Fields Cnr. — Dudley
21. Ashmont — Forest Hills
22. Ashmont — Dudley via Talbot
23. Ashmont — Dudley via Wash.
28. Mattapan — Arborway
29. Mattapan — Egleston
32. Cleary Sq. — Arborway
34. Dedham Line — Arborway
35. Stimson — Arborway
37. Vermont St. — Arborway
38. Wren St. — Green St. Sta.
40. Georgetowne — Arborway
41. Centre & Elliot — Dudley
42. Egleston — Dudley
43. Egleston — Stuart St
44. Seaver St. — Dudley
45. Franklin Pk. — Dudley
46. Heath & S. Hunt. — Dudley
47. Kenmore — Bos. City Hosp.
48. Bos. State Hosp. — Dudley
49. N'hampton — Kneeland St.
50. Cit. Sq. — Arborway via West
55. Queensbury — Boyl. & Fairfld.
59. Chestnut Hill — Forest Hills
60. Chestnut Hill — Kenmore
65. Brighton — Kenmore
66. Allston — Dudley
68. E. Concord — Copley
692. U.Mass. — Forest Hills

EXISTING BUS SYSTEM

(FIG. III-2A)

EXISTING MBTA FEEDER BUS SERVICE, SOUTHWEST CORRIDOR

Route No.	Description	Trip Time	Approximate Frequency (Minutes) Peak Hours	Mid-day	Night	Sat.	Su.
1	Harvard-Dudley	26	6	10	20	11	11
5	Broadway Station/Back Bay	25	15/20	-	-	-	-
9	City Point-Broadway & Tremont	16	12/13	15	30	15	10
10	City Point-Dudley	24	9	10	40	15	15
11	Bay View-Kneeland	20	8	15	30	12	20
13	Savin Hill-Northampton	12	20	20	-	40	-
15	Kane Square-Dudley	17	9	10	30	10	15
16	Egleston & Franklin-Andrew	14	11	20	30	20	20
17	Fields Corner-Andrew	15	12	15	40	15	20
19	Fields Corner-Dudley	17	20	-	-	-	-
21	Ashmont-Forest Hills	18	15/25	45	-	-	-
22	Ashmont-Dudley via Talbot	20	8	9	40	12	20
23	Ashmont-Dudley via Washington	22	6	11	40	12	20
28	Mattapan-Arborway	15	20/30	-	-	-	-
29	Mattapan-Egleston	20	5	12	25	15	12
32	Cleary Square-Arborway	15	4/5	15	30	12	30
34	Dedham Line-Arborway	15	5/6	15	30	10	30
35	Stimson-Arborway	23	15	30	90	30	90
37	Vermont St.-Arborway	15	15	30	90	30	30
38	Wren St.-Green St. Station	20	15/16	23	40	23	40
40	Georgetowne-Arborway	16	40	45	-	-	-
41	Centre & Eliot-Dudley	15	9	12	30	12	30
42	Egleston-Dudley	9	9	12	20	12	20
43	Egleston-Stuart Street	22	10	17	30	16	20
44	Seaver St.-Dudley	10	9	12	20	12	11
45	Franklin Park-Dudley	14	9	12	30	10	30
46	Heath & S. Huntington-Dudley	11	30	30	30	30	30
47	Kenmore-Boston City Hospital	24	20/18	30	-	-	-
48	Boston State Hospital-Dudley	24	60	-	-	-	-
49	Northampton-Kneeland St.	12	30	30	-	30	-
50	City Square-Arborway via West	20	20/25	30	-	30	-
55	Queensbury-Boylston & Fairfield	12	25/15	30	30	30	30
59	Chestnut Hill-Forest Hills	30	40	90	-	70	-
60	Chestnut Hill-Kenmore	30	20/25	25	30	25	30
65	Brighton-Kenmore	24	20	30	-	-	-
66	Allston-Dudley	26	7	12	30	12	15
68	E.Concord-Copley	12	35	35	-	-	-
692	U.Mass-Forest Hills	27	20/30	60	-	-	-

(FIG. III-3)

ORANGE LINE SOUTH RIDERSHIP TRENDS - TWO-WAY 24 HOUR BOARDINGS[1]

Year	Total	Stations: Forest Hills	Green	Egleston	Dudley	Northampton	Dover	Essex
1950	144,207	22,600	4,200	15,200	62,107	9,200	7,600	23,300
1951	139,500	21,500	4,000	14,900	59,600	9,800	7,200	22,500
1952	130,500	20,300	3,900	13,500	56,600	8,700	7,100	20,400
1953	126.600	20,300	3,400	12,800	56,200	8,600	7,000	18,300
1954	121,900	20,900	3,600	12,400	53,300	7,700	5,600	18,400
1955	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1956	102,600	19,100	2,900	10,900	43,300	6,000	5,000	15,400
1957	103,200	19,400	3,100	12,200	43,300	6,200	4,800	14,200
1958	100,000	19,300	2,900	12,300	43,400	5,800	4,600	11,700
1959	103,000	19,300	2,800	10,900	41,600	5,400	11,500	11,500
1960	101,300	18,900	2,900	11,300	41,100	5,300	10,900	10,900
1961[2]	61,600	17,900	2,800	7,400	16,800	4,900	4,900	6,900
1962	58,700	16,400	2,800	6,400	14,800	4,300	4,300	9,700
1963	58,300	17,600	1,100	6,100	15,700	4,600	4,000	9,200
1964	56,800	16,800	2,200	5,600	14,000	4,600	4,400	9,200
1965	55,400	17,000	2,300	5,800	13,200	4,400	4,300	8,400
1966	55,200	17,800	2,100	5,800	12,900	4,200	4,300	8,100
1967	54,000	17,300	2,200	5,400	12,500	4,200	4,600	7,800
1968	48,300	16,100	1,900	4,900	10,600	3,700	4,200	6,900
1969	51,100	16,000	2,100	5,700	11,200	4,100	4,200	7,800
1970	45,532	15,094	1,802	5,079	10,285	3,705	3,302	6,265
1971	45,892	15,527	1,907	5,375	9,501	3,952	3,368	6,262
1972	43,898	14,104	1,790	4,961	9,031	3,876	3,710	6,426
1973	42,242	13,280	1,749	4,763	8,507	3,856	3,638	6,452
1974[3]	36,418	10,599	1,541	4,039	7,645	3,692	3,068	5,834

ARBORWAY LINE RIDERSHIP TRENDS - TWO-WAY 24 HOUR BOARDINGS[1]

Year	Total Boardings	Year	Total Boardings
1950	17,000		
1951	17,500	1963	12,100
1952	15,100	1964	12,700
1953	17,500	1965	14,300
1954	18,400	1966	15,000
1955	15,600	1967	15,000
1956	16,700	1968	15,100
1957	17,500	1969	14,400
1958	15,700	1970	13,109
1959	16,300	1971	13,254
1960	16,300	1972	14,243
1961[2]	11,100	1973	12,640
1962	11,300	1974[3]	14,649

[1]SOURCE: MBTA - one day turnstyle counts, early December

[2]NOTE: Changes in method of counting in 1961

[3]NOTE: In 1974, there were about 6,000 holders of MBTA Prepaid Passes which are not included in above counts.

(FIG. III-4)

COMMUTER RAIL RIDERSHIP BY STATION (1968 - 1974)[1]

Needham Branch

Station	1968	1969	1971	1974
Needham Heights	68	77	53	75
Needham Center	156	161	118	147
Needham Junction	274	313	248	287
Birds Hill	303	311	260	299
West Roxbury	85	167	157	166
Highland	94	107	90	106
Bellevue	122	130	123	105
Roslindale	231	240	201	182
TOTAL - Needham Branch	1,433	1,506	1,250	1,367

Franklin Branch

Station	1968	1969[2]	1971[2]	1974
Franklin	166	137	N/A	119
Norfolk	33	28	33	43
Walpole	77	66	42	62
Plimptonville	11	8	4	6
Windsor Gardens	N/A	N/A	78	83
Norwood Central	305	319	203	282
Norwood	93	82	103	134
Islington	61	64	69	87
Rustcraft	4	0	0	1
Endicott	203	210	185	198
TOTAL - Franklin Branch	953	914	717	1,015

Providence (Main Line)

Station	1968	1969[2]	1971[2]	1974
Providence	184	N/A	N/A	102
Pawtucket	33	N/A	N/A	37
Attleboro	203	N/A	N/A	202
Mansfield	272	N/A	N/A	346
East Foxboro	11	N/A	N/A	70
Sharon	350	210	285	364
Canton Junction	407	394	370	427
Route 128	741	643	500	379
Readville	62	79	59	94
Hyde Park	148	165	144	89
Mount Hope	20	13	16	9
TOTAL - Main Line	2,431	1,504	1,374	1,787

Stoughton Branch

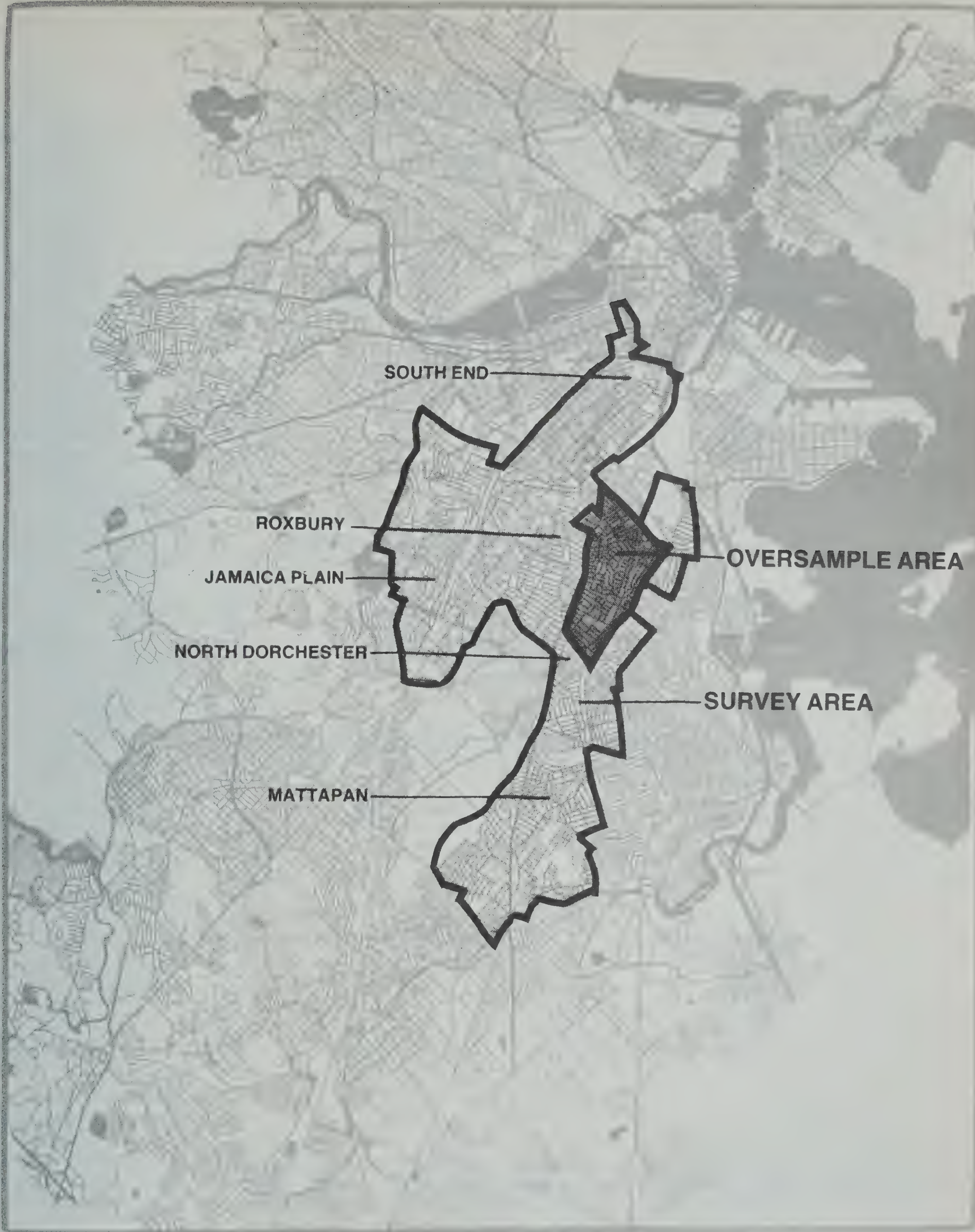
Station	1968	1969	1971	1974
Stoughton	215	303	N/A	220
Canton	42	37	22	29
TOTAL - Stoughton Branch	257	340	22	249

Summary

	1968	1969	1971	1974
Needham Branch	1,433	1,506	1,250	1,367
Franklin Branch	953	914	717	1,015
Providence (Main Line)	2,431	1,504	1,374	1,787
Stoughton Branch	257	340	22	249
TOTAL COMMUTER RIDERSH.	5,074	4,264	3,363	4,418

[1]SOURCE: Penn Central Conductor's Audits

[2]NOTE: Does not include persons boarding commuter rail who reside outside MBTA district.



SOUTHWEST SPECIAL MOBILITY STUDY AREA

SCALE

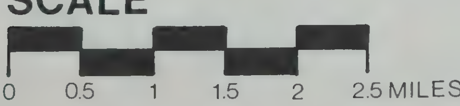


FIGURE III-5

(FIG. III-6)

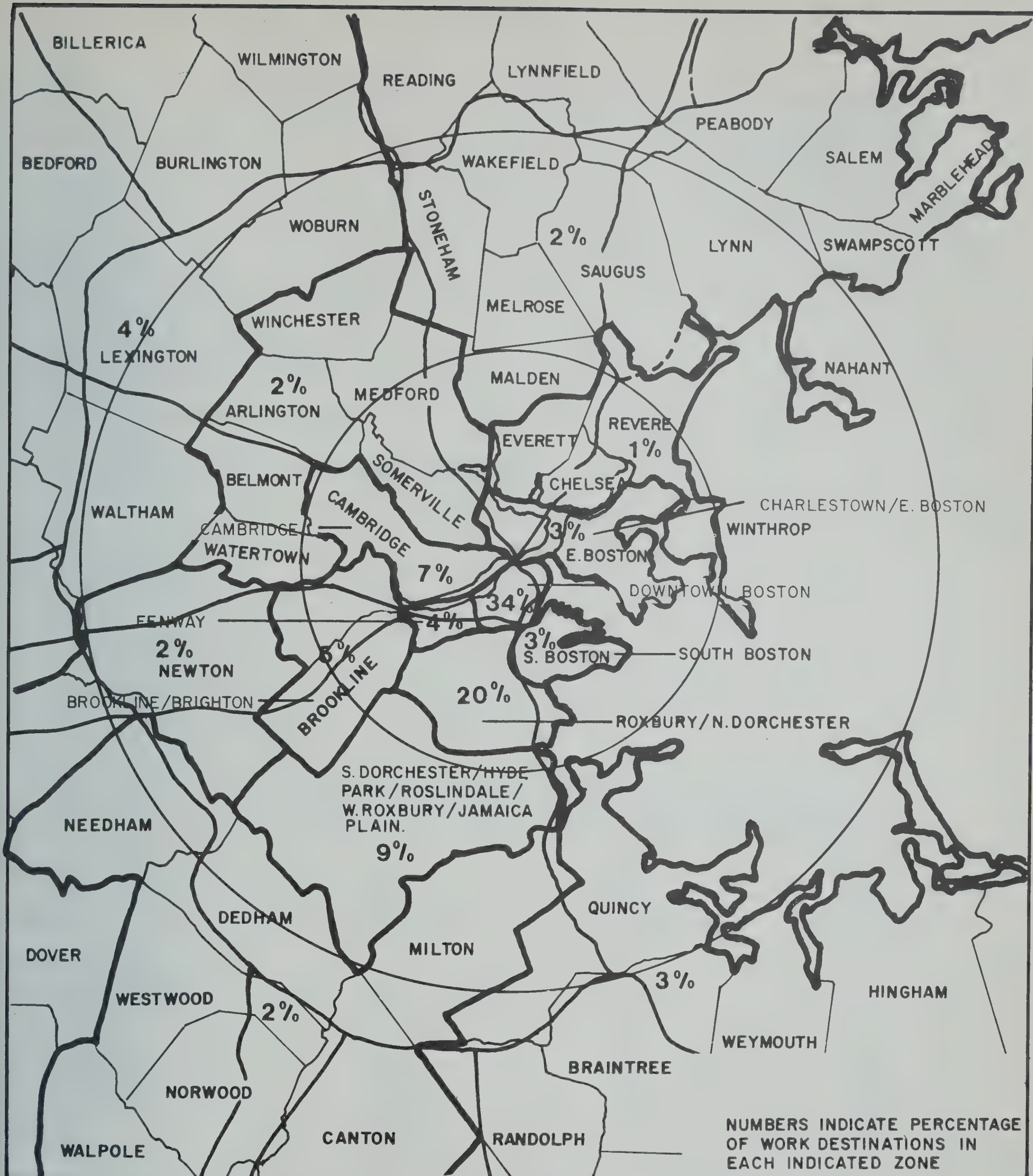
SURVEY AREA MODAL USE BY PURPOSE AND INCOME

Percentage of Population Categories Using Various Modes of Transportation for Trip Purpose Indicated

	Income less than $6,000	Income more than $6,000	Elderly	Total Population
		Work Trips		
Taxi	neg.	neg.	---	0.7
Auto	26	46	---	40.0
Walk	11	12	---	11.0
Orange Line	24	14	---	17.0
All Transit	63	41	---	48.0
		Grocery Shopping Trips (to)		
Taxi	6	3	2	5.0
Auto	32	60	45	47.0
Walk	42	26	41	32.0
Transit	20	11	12	17.0
		Grocery Shopping Trips (from)		
Taxi	26	15	13	21.0
Auto	31	60	45	48.0
Walk	31	18	34	23.0
Transit	11	7	8	8.0
		Medical Trips		
Taxi	19	11	16	14.0
Auto	23	46	29	13.0
Walk	16	12	17	13.0
Transit	26	16	21	21.0
Transit*	26	16	21	21.0

*More than 1 transfer

Source: BTPR Special Mobility Study, Commonwealth of Massachusetts, April 6, 1973. The "Survey Area" includes portion of the South End, Roxbury, North Dorchester, Jamaica Plain; see map, Figure III-5.



DISTRIBUTION OF WORK DESTINATIONS FROM SPECIAL MOBILITY STUDY AREA

FIGURE III-7

(FIG. III-8)

EXISTING TRANSIT SERVICE FREQUENCY IN SOUTHWEST

	HEADWAY (1) (Trains/buses)		
	Peak	Mid-day	Evening
Orange Line	4	6	15
Arborway Green Line (3 minute headway at peak hour to Northeastern)	6.5	5	12
Mattapan-Egleston Bus Route	5	12	30
Ashmont-Dudley via Talbot Avenue Bus Route	5	10	40
Mattapan-Arborway Bus Route	15	30	None

(1) Minutes between successive vehicles

(FIG. III-9)

TYPICAL DOOR-TO-DOOR TRAVEL TIMES TO DOWNTOWN
(Intersection of Washington and Summer Streets)

Location	Auto Distance (miles)	Auto Time (minutes)	Transit Time (minutes)
Dudley Square	3.4	14	21
Roxbury Crossing	4.0	16	27
Grove Hall	4.4	18	33
Forest Hills	5.9	22	27
Roslindale	8.1	26	32
West Roxbury	9.1	29	35
Readville	10.4	38	36
Needham	14.8	42	55

SOURCE: CTPS Highway and Transit Networks

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

STUDY AREA

ARTERIAL STREET SYSTEM

ARTERIAL STREETS A.D.T. – OVER 10.0

MINOR ARTERIAL STREETS A.D.T. – 5.0 – 10.0

OTHER IMPORTANT STREETS A.D.T. – UNDER 5.0

EXISTING TRAFFIC SIGNALS

DIRECTION OF TRAFFIC FLOW

NORTH

SCALE

0 1000 2000 3000

FIGURE III–10

ARTERIAL STREET SYSTEM

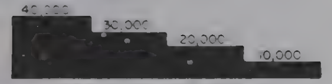
SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

STUDY AREA

AVERAGE DAILY TRAFFIC



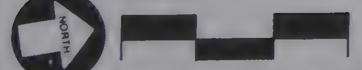


FIGURE III –11

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

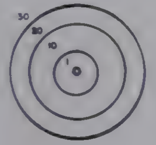
ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

STUDY AREA

REPORTED TRAFFIC ACCIDENTS 1972–1974

LEGEND



● – ONE PLUS ACCIDENTS PER YEAR

SCALE

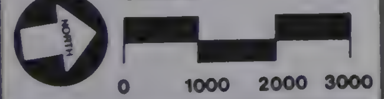
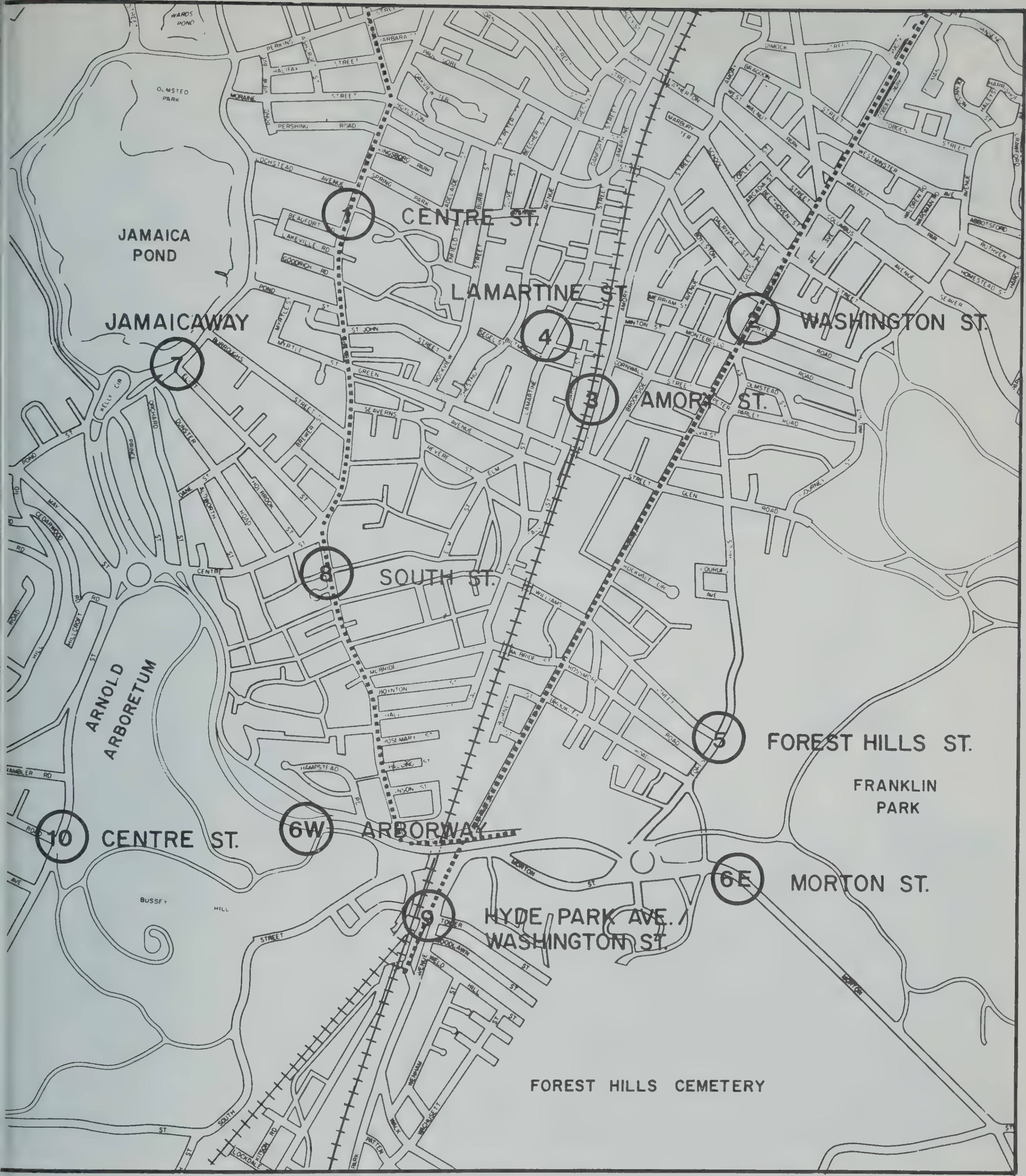


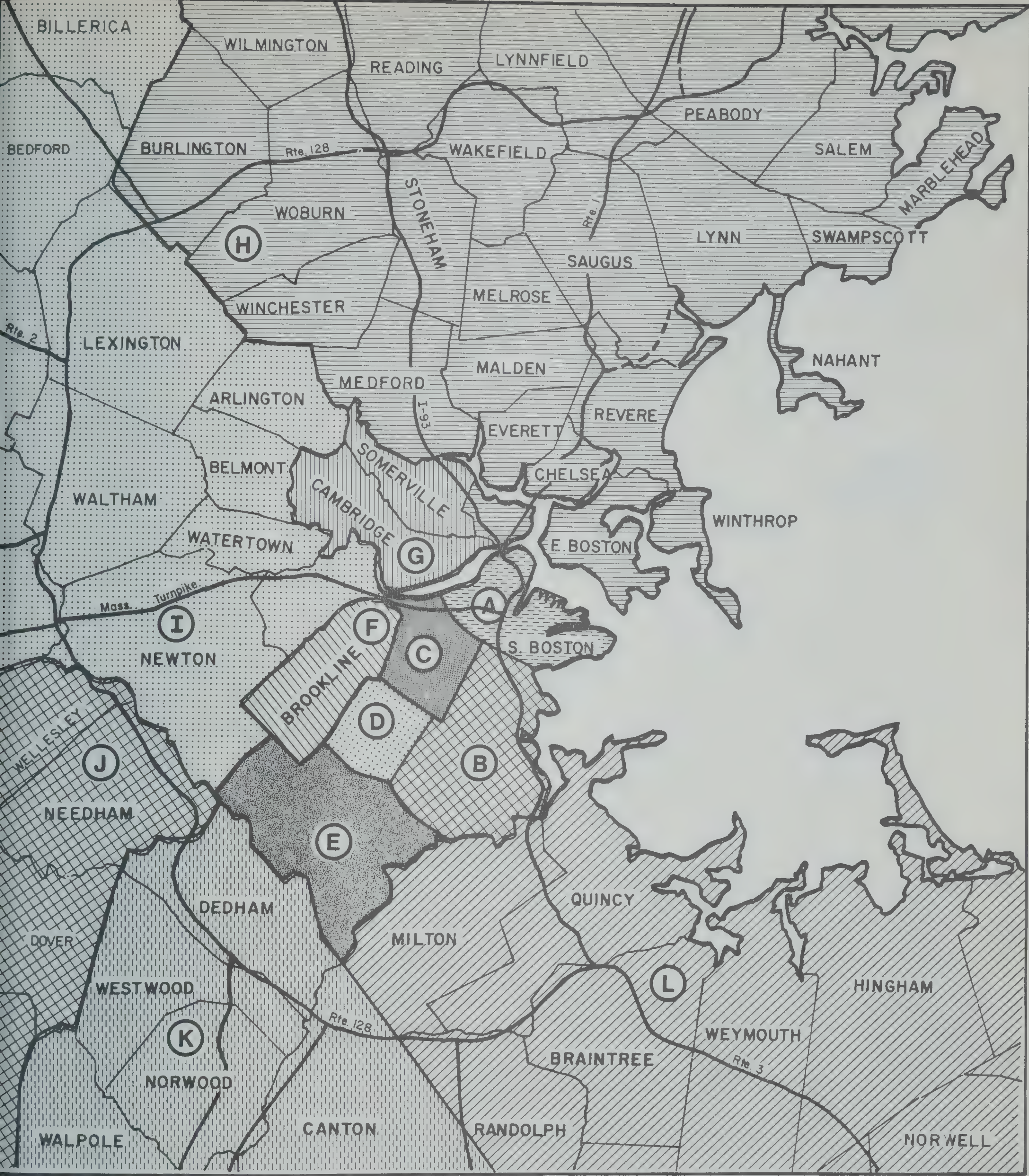
FIGURE III-12



ORIGIN / DESTINATION STUDY STATION LOCATIONS

FIGURE

III-13



TRAFFIC ZONES

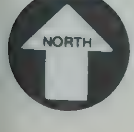
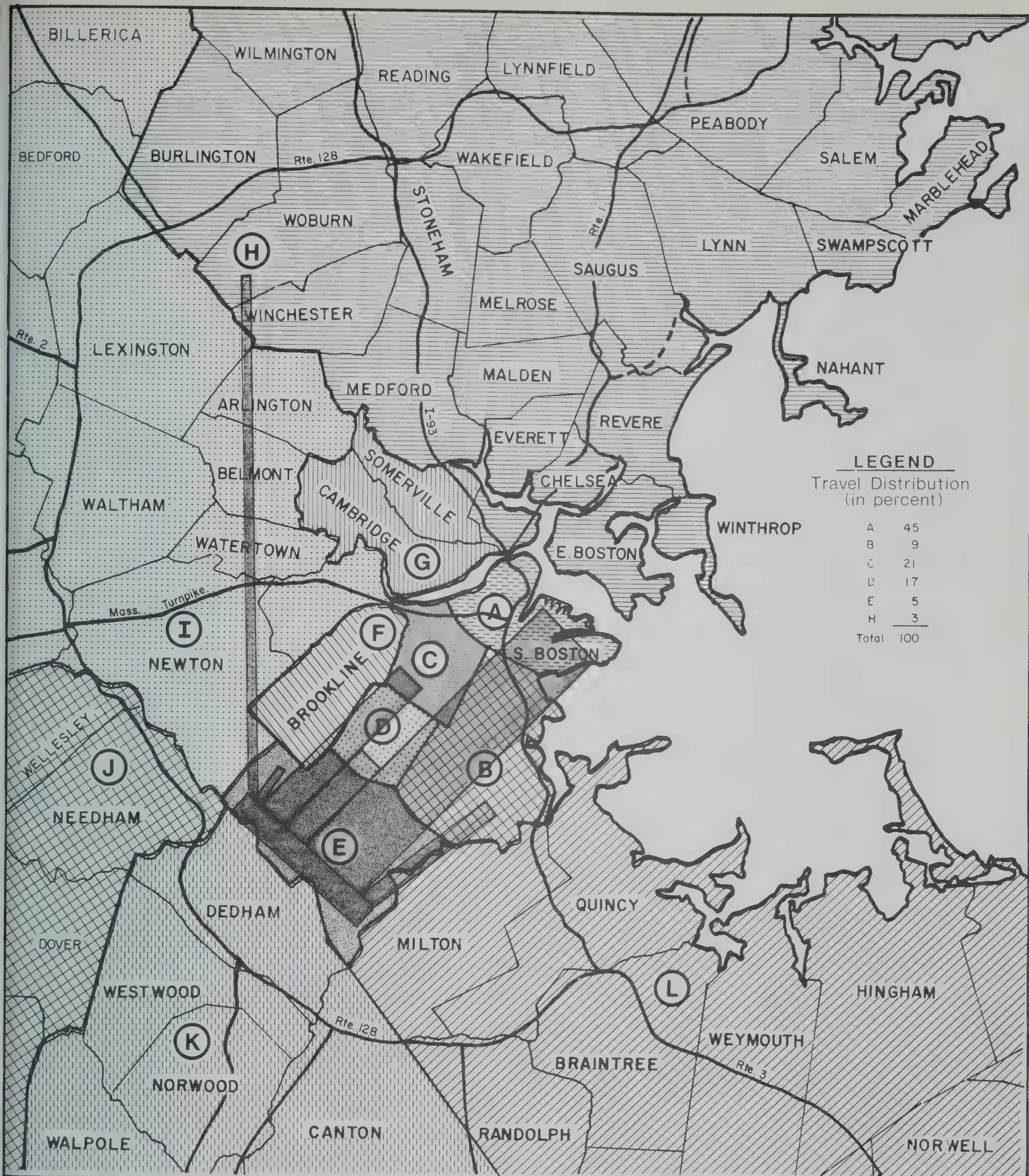


FIGURE
III–14



TRAFFIC DESIRE LINES FROM AREA E

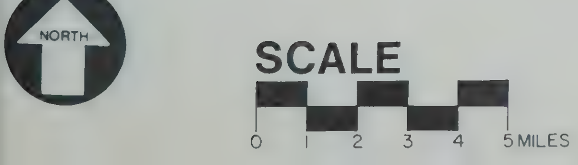
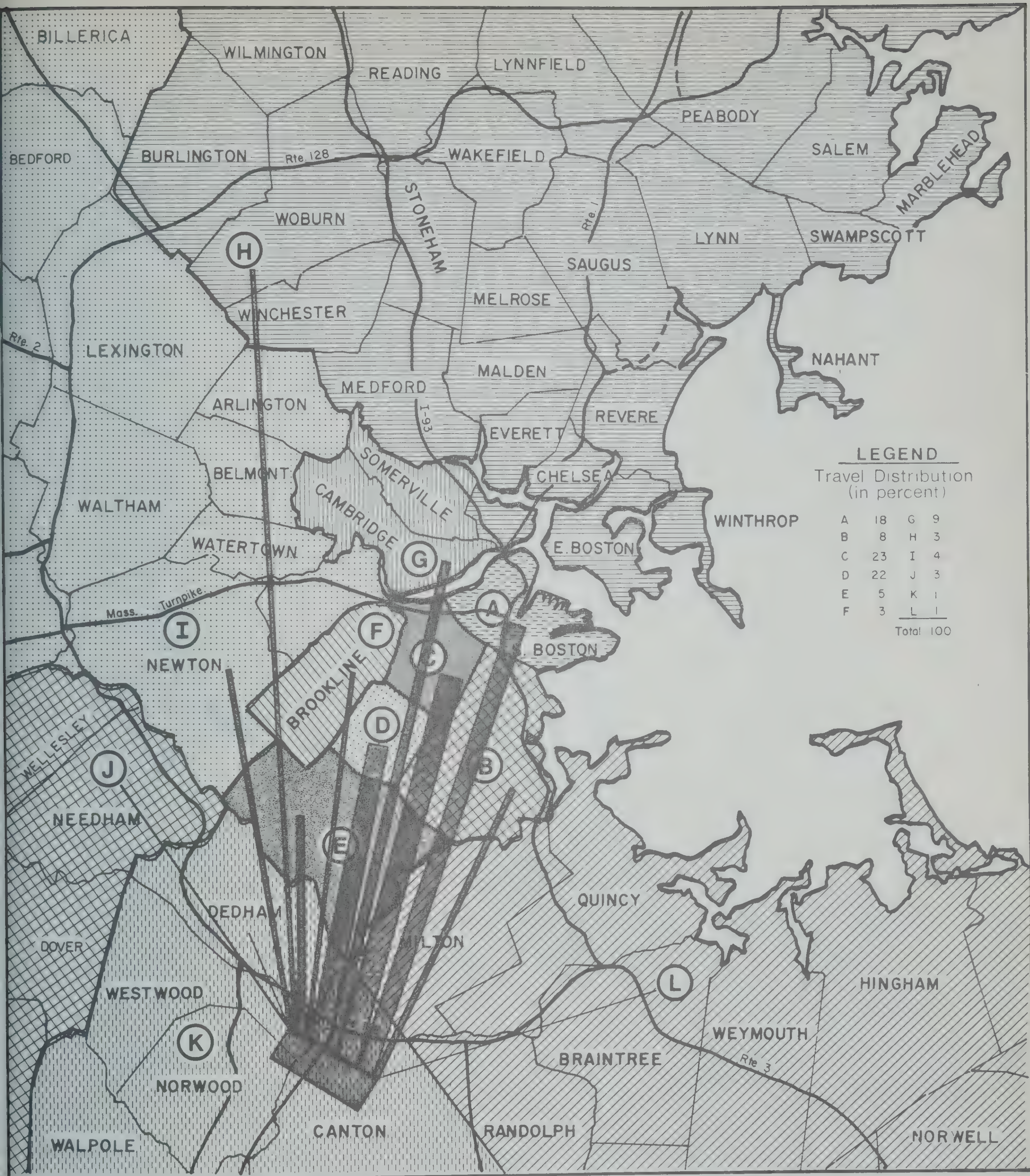


FIGURE
III-15



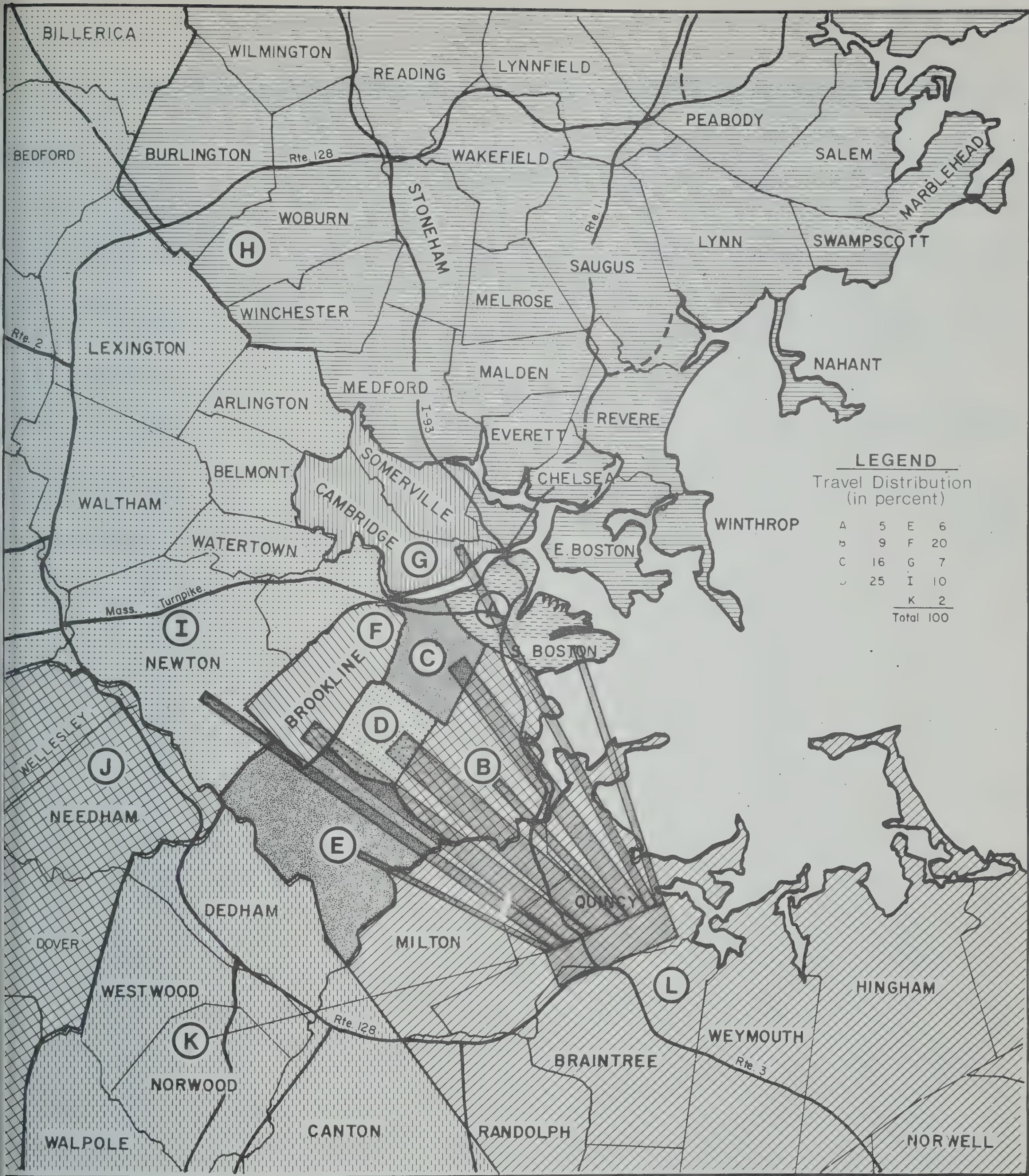
TRAFFIC DESIRE LINES FROM AREA K

NORTH

SCALE

0 1 2 3 4 5 MILES

FIGURE III-16



TRAFFIC DESIRE LINES FROM AREA L

NORTH

SCALE

0 1 2 3 4 5 MILES

FIGURE III-17

(FIG. III-18)

OUTBOUND TRAVEL TIMES (Minutes) -- LEVERETT CIRCLE TO ROUTE 128

Route	Approx. Distance	Peak/Off-Peak Travel time		Daily Volume	
		1963	1971	1963	1971
3A/Morrissey Blvd./ Dorchester Avenue/ Central Artery	11.5	35/30	44/29	35,000	45,000
Southeast Expressway/ Central Artery	11.5	30/30	32/15	71,000	97,000
VFW Parkway/ Jamaicaway/ Storrow Drive	13.5	39/32	48/27	27,000	40,000
Route 9 Storrow Drive	10.5	37/31	37/24	37,000	33,000
Massachusetts Turnpike	13	-	24/16	-	55,000

CHAPTER FOUR: IDENTIFICATION AND DESCRIPTION OF PROJECT ALTERNATIVES

4.0 IDENTIFICATION AND DESCRIPTION OF PROJECT ALTERNATIVES

An essential element of any planning and design process is the consideration of alternative ways to achieve project objectives. The most obvious alternatives are the various project alignments and configurations dictated by engineering, structure, physical, economic and environmental consequences. Because of this, additional alternatives must be considered which approach the achievement of objectives, but which also reduce environmental impacts to an acceptable level. These include nonstructural or minimum action alternatives. Finally, the impacts of implementing the project must be assessed.

This section describes the process by which many project alternatives were identified and evaluated. In addition it describes the alternatives selected for in-depth study and impact analysis. It should be indicated that in all cases dimensions shown are desirable design criteria but may be subject to change as the detailed design progresses.

As such it reviews the BTPR analysis which led to the basic Southwest Corridor strategy of relocating the Orange Line to the Penn Central, while proceeding simultaneously with the development of "replacement" service in the Washington Street sub-corridor, commuter rail improvements south of Forest Hills and improvements to the rail facility through Roslindale, West Roxbury and to Needham. The results of a more detailed analysis of the optimal location and configuration of the Orange Line facility is also presented as is an analysis concerning the requirements for railroad tracks in the corridor.

4.1 Background of the Planning Process

The analysis of the mass transportation alternatives in the Southwest Corridor can be usefully divided into two stages. In the first stage the regional, corridor-wide need for services was examined in terms of alternative program packages comprised of various facility combinations. The methodology applied in this phase was one appropriate for a high aggregation, sketch planning study designed to allow a rapid narrowing of regional alternatives. The second stage of analysis undertook the development of one particular transit project within the context established as a result of the conclusions drawn in the first stage. A more detailed methodology was applied in this second stage.

The Boston Transportation Planning Review (BTPR) carried out the examination of regional program packages, and established a single transit strategy for major facilities in the corridor. Following the BTPR, a continuing environmental assessment process has carried on the second stage, the project specific phase, of the Corridor's transit planning activity.

4.2 Identification of Regional Alternatives

Definition of the project corridor precipitated various alternative configurations for the relocated Orange Line. Alternatives were developed for testing, with the likelihood that some would be eliminated and others would be modified as the study process progressed. At the same time, the "technology" alternatives were grouped with other transit improvements, to identify clearly the entire system of alternatives which might be possible. The entire set of technology alternatives are briefly described in Appendix C. The transit packages which were evaluated are described in Section 4.4.1.

4.2.1 Transit Packages Evaluated

The analyses of transit packages include a series of ten facility packages with alternative technologies and levels of service for each of the radial line-haul corridors within the Southwest. A fixed total amount of transit patronage was assumed for each alternative, along with an estimate of travel time, service frequency, revenue, operating costs, capital costs, and net benefits.

Description of Transit Packages (Fig. IV-1)

Package 1. This package consists of the existing transit service to be used as a basis for comparison. Line-haul facilities include the Orange Line elevated via Washington Street to Forest Hills, and the present commuter rail services. They include four routes, all stopping at South Station and Back Bay station. The four are the Needham Branch, which merges with the mainline at Forest Hills, the Franklin Branch which merges at Readville, the Stoughton Branch which merges at Canton Junction, and the main line itself which carries commuter service as far as Providence.

Package 2. This package retains the existing Orange Line. It replaces commuter rail with dual-power vehicles which would make present commuter rail stops including Back Bay station, but would be routed via the South Cove tunnel into the downtown Orange Line subway rather than to South Station.

Package 3. In this package, the present Orange Line is replaced by a relocated rapid-transit line in the Penn Central main line right-of-way to Forest Hills. The rapid-transit line also extends along the Needham Branch right-of-way to Route 128, replacing that commuter rail service. The Franklin, Stoughton and mainline commuter rail services are retained and upgraded.

Package 4. Rapid transit is configured as in Package 3, but commuter rail is relocated to the Dorchester Branch of the Midlands Division, which is upgraded, including necessary trackwork, to permit a high level of service.

Package 5. Again, rapid transit is configured as in Package 3, but commuter rail is discontinued. Express buses to Forest Hills would shuttle from Route 128 park-ride and the commuter rail service area beyond. Thus the package is dependent upon highway construction south of Forest Hills.

Package 6. This package is dependent upon highway construction through the entire Corridor and discontinues commuter rail services. Express bus service would be provided between a new terminal at South Station and (a) Route 128 and I-95, and (b) Route 128 at Needham. The latter would be provided by constructing a busway in the Needham Branch rail right-of-way. The express buses would serve park-ride passengers at Route 128 and the present commuter rail service area beyond. The existing Orange Line is retained in this package.

Package 7. Commuter rail is discontinued in this package. Rapid transit is relocated to the railroad main line and extended beyond Forest Hills both to Route 128-Needham and Route 128 beyond Readville. Feeder buses would supplement park-ride for access from points outside Route 128.

Package 8. This package builds on Package 3 by adding a second new rapid-transit line, in subway, replacing the elevated between South Cove and Dudley and extending to Grove Hall, Franklin Park and Mattapan.

Package 9. This is a second dual power vehicle scheme, in which the rapid transit stations north and south of Forest Hills are implemented and dual power trains combine the commuter rail and inner-area rapid-transit functions. The present Orange Line is discontinued.

Evaluation of Preliminary Packages

Evaluation of the ten packages involved the following elements:

- Estimation of travel time ridership, and revenue for each line-haul condition imposed by each package.

- Estimation of appropriate service frequency and resulting operating cost for each line-haul facility based on the ridership estimates.

- Summarization of user and operator economic benefits for each package, compared with Package 1.

- Estimation of the capital cost of each package, and comparison of capital costs with economic benefits.

- Consideration of the extent to which elements in each package respond to the transit problems enumerated earlier in the report.

- Consideration of the factors influencing the analysis -- impact of improved transit productivity, marginal costing of commuter railroad service, operational and line-balance considerations for the Orange Line, public attitudes toward technologies, local service implications, institutional problems, and reliability inherent in each technology.

4.2.2 Methodology

The broad regional analysis presented in this Section is based on a simple fixed-transit trip table (ridership estimates), which was created by the "Fratar" process from 1963 transit origin-destination data. The total magnitude of transit demand does not rise and fall in correlation with the quality of supply characteristics specified by each of the modal combinations. The analysis described in Section 4.3 is based on the full application of the urban transportation planning process, with specific examination of the effect of trips which divert to transit from private transportation, and trips which are "induced" by the existence of the new facility itself. Because of the difference in methodology, the transit market descriptions presented in Section 4.2 are different in nature from the more complete descriptions provided in Section 4.3.

Evaluation measures utilized in Section 4.3 provide a more accurate simulation of trip-making behavior than the sketch-planning summaries of Section 4.4. That section examines the applicability of several possible modes to each of the general market areas by employing an index entitled "Perceived Travel Speeds". These calculations show the relative level of service quality experienced by these areas by dividing the total weighted travel time to down-town by the distance to downtown. Weighted travel times are based on in-vehicle time plus 2.5 perceived minutes for every minute of waiting time.

Ridership

The analysis of ten packages assumes a fixed transit trip table - that is, the number of trips in the Corridor via transit is assumed to be the same regardless of the improvement package considered. These are shown in Fig. IV-1 for the various subareas in the Southwest. These Corridor trips were assigned to the facilities in each package.

The oversimplification that results from assuming a constant mode split tends to understate and lessen the difference among packages. There is evidence in the later analysis, however, that the full-system sensitivity test of demand does not alter the ranking of packages.

The facilities evaluated are limited to the line-haul parts of the network, but to varying degrees, shorter local trips also are accommodated, so that the number of trips carried by any given facility being evaluated varies from one "package" to another. Further variation occurs because of differing attraction of trips at the edges of the Corridor. Finally, the facilities evaluated do not uniformly serve identical portions of each trip; passengers may board a train at Needham Junction, for example, but board at Route 128 if rapid transit is the available facility.

The analysis apportions revenues and operating costs so that fair comparisons are made despite these differences.

Travel time

Package 1 is the existing configuration of line-haul transit facilities in the Southwest and has been used as a basis for evaluation of other packages. For each, travel times have been estimated. Improvements in travel time would accrue from the following sources:

- Reduced running time due to higher performance equipment, better alignment, different station spacing, etc.

- Reduced waiting time due to improved headways.

- Reduced transfer time due to through routing, improved physical transfer conditions, or more frequent connecting services.

While overall travel time reductions give a broad measure of the amount of improvement gained by an alternative, the locations affected and the number of users in each location also are of importance. If possible, transit in areas not well served at present should be improved, to be more on a par with better-served areas, and the service level should not be reduced in any area.

The present level of service to the various subareas can be indicated by calculating peak period "behavioral time" (travel time plus a weighted indication of time spent walking or waiting which reflects the psychological response to the inconvenience). This was estimated for trips to downtown Boston, and divided by the distance from the centroid for that area to downtown. The results of this process are shown in Fig. IV-2.

One would expect higher speeds for the longer trips and this is generally demonstrated by the results of this analysis. The areas most in need of improved transit service on this basis are the Main Line railroad corridor, West Roxbury, Franklin Park-Mattapan, and Needham service area.

The various transit improvement alternatives affect these service areas in different ways, as illustrated by Fig. IV-3.

It is apparent that the present Orange Line corridor as far south as Dudley should have service in the future. Service south of Dudley Station that is currently provided by the Orange Line would be provided by: extending the existing and proposed feeder bus service from Eggleston Station to Jackson Square and by the close proximity of the proposed new Green Street and Forest Hills station to the existing stations so named.

These comments only apply with respect to service between each Southwest service area and downtown Boston. Alternatives that provide non-stop point-to-point service (express bus, for example), would serve no intra-corridor function, and the wider stop spacings of commuter rail and rapid transit would have less local service value than the frequent stops of light rail or local bus. Thus, Fig. I -3 overstates the value of express bus compared to commuter rail or rapid transit. It also overstates the value of rapid transit to Mattapan in comparison with light rail.

Fig. IV-4 records the result of an analysis of user benefit which is based upon travel time. The calculations subtract net cost of each service from estimates of user benefit. User benefit is calculated by multiplying travel time saved by a fixed value of $3.00 per hour, an arbitrary though standard measure.

4.2.3 Conclusions from Regional Alternatives Testing

With the conclusion of the BTPR, a consensus was reached that the Orange Line should be relocated to the Penn Central right-of-way, with some kind of replacement service supplied to the Washington Street sub-corridor. Of the 9 alternative systems compared with the no-build case, the highest level of net benefit (defined as level of user benefit minus net increase in operating cost over increase in revenue) was attained by process alternative 9 which offered Orange Line to Needham, CRR to the South, and replacement service to Mattapan.

During this planning, a considerable effort was undertaken to seek the most appropriate technological solution to each of the market areas revealed in the sketch planning exercise. Through an extensive process, separate neighborhood representatives began to define more clearly their separate transit needs. The South End articulated a demand for locally oriented, multi-stop, on-surface service to downtown. The Roxbury community focused on transportation needs which extend out from Dudley to the Grove Hall and Mattapan areas. Jamaica Plain focussed on the desirability of obtaining transportation benefit from a facility which bisected the community with local service.

The BTPR ended with a broadly based decision to remove the Orange Line from the elevated alignment to the Penn Central corridor, while simultaneously developing both South End replacement, and Roxbury-Mattapan services. From this basic strategy came the decision to focus on the relocated Orange Line as one major project within the corridor.

Consistent with this general corridor strategy, the South Cove to Forest Hills project was defined for detailed environmental analysis, as other corridor planning efforts were accelerated. The sections of this report which follow present the environmental analysis undertaken for the specific South Cove to Forest Hills project. The Forest Hills to Needham alternative modes are being examined in a separate Environmental Impact Analysis. Initiation of a feasibility study for transportation improvements to the South End/Roxbury/Mattapan/North Dorchester communities awaits UMTA approval.

4.2.4 Highways

In the recent past, regional planning was noted for the emphasis it placed on highway planning. This attitude was changed in the early 1970's, when the then Governor stopped all new expressway construction within the Route 128 Perimeter for a major restudy of the Boston region's transportation needs. Following the study made by the two-year, $3.5 million Boston Transportation Planning Review (BTPR), the Governor decided not to build the radial expressways planned for the region. He decided to rely more on mass transit and rail to move people in the denser core area. The Commonwealth of Massachusetts adopted a "balanced" transportation policy, calling for a combination of transit and highway investments, planned as part of unified transportation system. The Southwest Corridor studies of the BTPR support the concept of major rapid transit commuter and inter-city rail facilities on the alignment of the Penn Central trackage, paralleled by new or modified local streets and boulevards in place of the previously planned expressway.

4.3 Identification of Alternatives for the Southwest Corridor

4.3.1 Transportation Analysis - Narrowing of Transit Alternatives*

4.3.1.1 Background, Purpose, and Structure of Section

This section presents an examination of the transportation costs, and the distribution of transportation benefits associated with the proposed project and its alternatives. Included are an analysis of the rapid transit location and configuration, and an analysis of the railroad requirements.

---

*Section 4.3.1 and 4.3.2 and Appendix B were prepared by Central Transportation Planning Staff.

While the transportation analysis presented is consistent with, and follows logically from the BTPR analysis, its purpose and methodological characteristics are considerably different. The BTPR transit planning was undertaken on a "sketch planning" basis which would allow a significant number of regional combinations of services to be examined simultaneously. That analysis was sufficient to derive a basic transit planning strategy for the entire corridor, including the following four elements:

- Relocation of the Orange Line to the Penn Central alignment.
- Replacement services in and extending from the general corridor from which the Orange Line is to be removed.
- High speed commuter railroad service south of Forest Hills, shared with AMTRAK facilities.
- Provision of high quality rail service through West Roxbury to the 128/Needham area.

The BTPR technical work, however, did not bring the analysis of the proposed project to a level sufficient for the Capital Grant/Environmental Impact Analysis process requirements.

Following the BTPR, the Southwest planning process has included a detailed analysis of the transportation costs and benefits associated with the proposed project. This analysis has focused on such issues as the number of rapid transit tracks, and the number of conventional railroad tracks needed in the corridor. Consistent with environmental regulations, considerable attention has been given to the transportation impacts of both the "no build" and the option of reconstructing the transit facility along (roughly) the same alignment used today by the Penn Central.

This report presents the results of detailed examination of the transportation impacts of the proposed project and its alternatives.

Three possible alignments are examined in this section in terms of ridership, user benefit, and operating costs. In order of their presentation, they are:

- The "no build" Alternative - continued use of the elevated structure.
- The Penn Central Corridor.
- The Shawmut Avenue/Washington Street Alignment.

4.3.1.2 The No-Build Alternative

4.3.1.2.1 Background

The Orange Line between Essex Station and Forest Hills is the oldest high-platform line in the MBTA rapid transit system. The section from Dudley station to a point near Herald Street north of Dover Station opened in June 1901. Originally the line proceeded from there into downtown Boston via the Tremont Street subway of the Green Line. The present Washington Street tunnel and connecting ramp to the elevated at Herald Street were completed in 1908, and Orange Line cars were then diverted to this route. The final section from Dudley Station to Forest Hills station was placed in operation in November 1909.

The southern end of the Orange Line, from Dover Station to Forest Hills, has always been heavily dependent on feeder modes for collection and distribution of its riders. Currently 54 percent of the riders arrive by bus, 29 percent walk in, 14 percent park at stations and 3 percent are dropped off at stations. When the line first opened, feeder service was provided by streetcar routes, many of which pre-dated the elevated. From its opening date until the late 1920's the Orange Line served most of Dorchester via connecting trolley service, but with the completion of the Red Line to Fields Corner in 1927 and to Ashmont in 1928 many of the Dorchester feeder routes were reoriented to serve the Red Line, leaving the Orange Line with a reduced service territory to the east.

4.3.1.2.2 Ridership

Basic ridership information is presented in Fig. IV-5, and -6. The forecast for the "no build" alternative (or base case) predicts 33,320 daily northbound riders in 1980 (Fig. IV-5). This is a slight decline from current ridership, based on the fact that no travel time improvements are assumed, and that population is declining in the inner area served by the existing facility. It should also be noted that the "no-build" configuration assumes the abandonment of the existing unopened South Cove station.

4.3.1.2.3 User Benefit

This alternative served as the base against which the other two alternatives are observed. No "absolute value" of the present service is calculated in this comparative method.

4.3.1.2.4 Operating Costs

The present Orange Line south of Essex has the highest unit operating and maintenance costs of all existing MBTA rapid transit lines as a result of its location on an elevated structure. Although station spacing all along the Washington Street elevated averages from one-half to one mile, maximum train speed has always been restricted to 40 mph for safety reasons. In addition to this general speed restriction it has been necessary to impose temporary restrictions at various points where structural defects have been found, until these could be repaired. Because of these limited speeds, the average wages per car mile for train motormen and guards are 20 to 30 percent higher on the Orange Line than on the Blue Line or the Cambridge-Dorchester portion of the Red Line. (The South Shore extension of the Red Line is not relevant for comparison here because it contains a long section of express tracks.)

The elevated structure between Herald Street and Dudley Station is 75 years old and the balance of the structure is 67 years old. The older structure employs a lattice girder design that was considered obsolete by many engineers even at the time of construction due to its relatively low strength. The later structure south of Dudley is stronger than the original elevated because an improved design was used. Due to budgetary constraints, maintenance of the elevated structure itself in past years was inadequate to offset the effects of train loadings plus harsh New England weather. Consequently, major rehabilitation is now necessary to keep the structure usable at least until a relocated

line is built. If the "no build" option is selected, more permanent repairs will be required, and annual maintenance expenditures will have to be increased in order to prevent a recurrence of the present deterioration. Further, in the "no build" option the cost of the existing South Cove tunnel (valued at 13.3 million in 1968) would be a fixed cost of that course of action.

Track maintenance costs per mile are approximately twice as high on the Orange Line elevated as anywhere else on the MBTA rapid transit system. This is an inherent problem of elevated lines of this design due to the complex system of rail and tie fastenings required, and to hazardous working conditions.

4.3.1.3 The Penn Central Alignment

4.3.1.3.1 Background

The proposed Southwest Corridor alignment for the Orange Line relocation follows the route of the former Boston and Providence Railroad, which was opened from Park Square Boston to Readville in 1834 and to Providence, Rhode Island in 1835. As originally built the Boston and Providence crossed several streets at grade north of Forest Hills. The tracks were raised to the present embankment between Forest Hills and Northeastern University in the late 1890's

During the 1880's and 1890's extensive commuter services were established on most of the rail lines radiating from Boston. Service on several lines included turnback points less than ten miles from downtown Boston. Although these commuter rail operations provided much more frequent service than had previously been operated, most of them did not come close to matching frequencies of street railway and rapid transit services which began not long afterwards. This, combined with the automobile resulted in the demise of most of the short turn commuter rail services by 1920.

Following the opening of South Station in 1899 the intown terminal was shifted there from Park Square and a stop was added at the new Back Bay Station. Old New Haven Railroad schedules show that the original frequencies were still in effect in 1901 when the elevated opened to Dudley, but that by 1906 mid-day headways had been increased to 30 minutes. By 1912, three years after completion of the elevated to Forest Hills, the commuter rail turnback at Forest Hills had disappeared entirely. Dedham service had been somewhat reduced, and stations between Forest Hills and Back Bay were being served by Dedham trains.

The Boston and Providence alignment offers a unique opportunity to improve the quality of the Orange Line without the necessity of major new land taking. From an operations standpoint, relocation on the Boston and Providence would permit operating speeds limited for all practical purposes only by station spacing and equipment performance characteristics. With well-maintained track the speed limit for passenger trains between Forest Hills and Northeastern University is 80 to 90 mph. This is far beyond the requirements of rapid transit which would probably have a top speed of 60 mph.

The Relocated Orange Line alignment was included as part of the first priority "action program" in the 1966 Program for Mass Transportation, and the 1969 EMRPP Highway and Transit Plan. The alignment decision was re-affirmed in the 1972 BTPR study, and is included in the present "Transportation Improvement Plan".

4.3.1.3.2 Ridership Characteristics

Ridership forecasts for this alignment are summarized in Fig. IV-8, and -9.

The Orange Line relocated to the Penn Central alignment would carry substantially more riders than the no-build alternative. Its 1980 daily inbound ridership is estimated to be 55,565 (Fig. IV-8) as opposed to 33,320 for the "no build" (Fig. IV-5). The significant increase in daily ridership stems directly from the alignment through the Back Bay area. This alignment contributes to ridership both from the Southwest, and from other points in the network which benefit from the improved downtown distribution provided by the relocated Orange Line.

4.3.1.3.3 User Benefit[1]

New riders would be drawn to the system because they would save travel time. Riders who use the Orange Line regularly would benefit from travel-time reductions. All in all, travel-time savings would substantially exceed any travel-time increases for that portion of the line affected. Using a time value of $3.00 per hour, net savings to users from the south would amount to $3.7 million per year if the Orange Line were relocated on the Boston Providence alignment. In addition to these user benefits, the relocated line would provide improved access to the areas around Back Bay South Cove for riders originating on the Orange Line north of Boston, from the Red and Blue Lines, from the Boston and Maine commuter and from the Green Line at Lechmere. As a result of the South Cove Extension Project, distribution of downtown riders would be improved for railroad passengers. The total benefits accruing to these riders would amount to $1.1 million per year. The sum of benefits discussed above amounts to $4.8 million per year. These do not take into account any measures that might be taken to offset net travel time increases for riders from east of the existing Orange Line. Due to the relatively long spacing between Essex, Dover, Northampton, and Dudley stations, a substantial portion of the present users of Dover and Northampton would be better served by frequent surface transportation on Washington Street to downtown than by the existing Orange Line. Although the running speed of such service would be slower than that of the Orange Line, stops would be much more closely spaced and therefore access time for the average user would decrease. This concept is presented in detail in the "comparative analysis section", later in this report.

4.3.1.3.4 Operating Costs[2]

Due to elimination of costly maintenance problems on the elevated line and higher productivity of trainmen, the relocated line would reduce annual operating and maintenance expenses on the Orange Line by an estimated $1.3 million per year based on 1974 unit costs. The increased demand for the new location would not affect the frequency of service required, because volumes on the Washington Station to Oak Grove portion of the line would control

---

[1] For an explanation the "user benefit" methodology see Appendix C.

[2] For an explanation of operating cost methodology see Appendix C.

scheduling considerations at all times when frequency was controlled by train capacity. Assuming a one-way fare of $0.25, the increased demand for the relocated line would increase Orange Line revenues by $3.2 million per year compared to revenues for the existing line in 1980.

A prime consideration in the analysis of operating costs is the possibility of providing an express track. The primary benefit of an express track would be lower costs resulting from more efficient use of manpower and equipment in meeting demand. Assuming that the express track were in service three hours each morning and three hours each evening in the peak direction five days a week, annual operating costs would be reduced by $0.4 mil. per year compared to a full local service. This would be accompanied by a net user disbenefit of $0.24 million per year. The reason for this is that an express plus local service would result in increased wait time for most riders, and this would not be offset by running time savings for express riders. The greatest potential savings would be in rolling stock capital cost. The express plus local service option would require four fewer four-car trains than would the full-local service. At a cost of $500,000 per car minus the capital cost of tracks, signals, power, right-of-way, etc., the net savings would be $3 million.

4.3.1.4 The Shawmut/Washington Tunnel Alternative

4.3.1.4.1 Background

As noted previously, the BTPR analysis of possible facility combinations at a regional scale studied the option of leaving the Orange Line in its present alignment, with low capital improvements along the Penn Central corridor. That study ultimately rejected the low-capital options then under consideration, and concluded that electrified transit service should indeed be placed in the Penn Central corridor, with some replacement, private right-of-way at-grade transit to be supplied in parts of the Washington Street corridor.

In the planning process undertaken for this environmental assessment, study participants have requested further information concerning a Shawmut/Washington Street location as an alternative to the relocated alignment for the Orange Line. This is partly based on a feeling that project costs for the relocated facility are higher than expected during the BTPR, and that this might affect the 1971 decision to drop the Shawmut/Washington option.

Therefore, this section of the report examines this option in terms of patronage, user benefit and operating costs.

The maximum running speed in this tunnel option would be about 55 mph, subject to restriction by station spacing, compared to 40 mph on the elevated. This combined with elimination of speed restrictions imposed due to structural defects on the elevated would result in a running time saving for the subway of 4.5 minutes between Forest Hills and Washington Station, including a stop at South Cove.

4.3.1.4.2 Ridership Characteristics

Detailed ridership information is presented in Fig. IV-12 and -13. One-way daily ridership for this alternative in 1980 is predicted to be 40,790 (Fig. IV-12) compared to 33,320 for the "no build" option and 55,565 for the Penn Central alignment. Because the subway retains stations in approximately their existing locations south of Dover, increased demand at these stations is a result of running time reduction rather than of providing service to new markets. Although the running time savings to downtown for the subway would be greater than those for the Southwest relocation at all stations south of Massachusetts Avenue and equal at Massachusetts Avenue, the alternative does not create an expanded market area as successfully as the relocation alternative.

4.3.1.4.3 User Benefit

The Shawmut/Washington tunnel alternative would have travel time savings of $3.1 million per year compared to the "no build" option for trips originating south of Washington Street. In addition, trips from the Orange Line north of Washington and from other lines using South Cove station as a distributor would have user benefits of $0.3 million per year. Total user benefits of the project would thus be $3.4 million compared to $4.8 million for the Southwest relocation. Orange Line revenue would increase by $1.1 million per year with the subway compared to an increase of $3.2 million for the Southwest relocation.

4.3.1.4.4 Operating Costs

The estimated operating and maintenance expenses for this alternative would be $2.0 million per year less than those of the "no build" option based on 1974 unit costs. This is $0.7 million per year more than the savings for the Penn Central relocation, due to shorter mileage, shorter running time and fewer stations. However, this savings is less than either the increase in revenue or the increase in user benefit for the relocation compared to the subway. The subway would not reduce rolling stock requirements compared to the Penn Central relocation.

4.3.1.5 Comparative Analysis of Alternatives

The preceeding descriptions have established the basic aggregate description of the transportation services to be provided by each of the three alternative Orange Line configurations. This section presents a summary description of the differences in transportation service areas and levels of service provided to the separate community sub-areas of the Corridor. This data provides the basis not only for the Orange Line location, but for further Southwest Corridor transit planning activities.

As revealed in previous sections and summarized in Fig. IV-15 the Penn Central alignment provides the highest level of ridership and user benefit of the three alternatives. This superiority in transportation service sense arises from the fact that the "relocated" configuration performs transportation services above and beyond the carrying of Corridor riders to the older, traditional section of the Central Business District. By arching over to the Back Bay area, and then continuing to the retail core, the relocated Orange Line distributes Southwest Corridor riders destined for the Back Bay, as well as transit riders from the rest of the radial transit network through the South Cove, Park Plaza, and Back Bay areas. Increased distribution possibilities would be available to railroad passengers at Back Bay station.

4.3.1.5.1 Ridership Comparison - North of Massachusetts Avenue

This combination of functions, (radial service plus distribution within the center of the network) accounts for some of the difference in the make-up of transportation services provided by the Penn Central alignment when compared with the other two alternatives tested.

Concerning the distribution function, the forecasts show that the relocated alignment provides service to some 13,000 riders (26,000 daily trips) who board at Back Bay and South Cove stations, neither of which exists in the "no build" configuration. Approximately 4,000 of these riders would get South Cove service in the Shawmut/Washington alternative, leaving nearly 9,000 riders to find other ways to the Back Bay area. As stated previously, travel time user benefits for downtown distribution riders are valued at $1.1 million per year over the base case for the relocated alignment versus $.3 million for the Shawmut/Washington alignment over the base case ("no build").

The core area configuration of the relocated alignment serves a land area with considerably higher transit trip making than does the Shawmut/Washington alignment. Specifically, within Boston Proper, (i.e., north of Massachusetts Avenue) the three stations of the relocated alignment would attract some 26,000 daily boardings, while the alternative routing would attract approximately 18,500. This superiority of core distribution holds true both for riders originating in the Southwest sector of the region, as well as for those approaching from other corridors. More than 8,800 Southwest northbound riders would get off at the inner 3 stations in the relocated alignment, versus about 6,800 in the Shawmut/Washington alternative.

By comparison, the "no build" alternative would have neither Back Bay service nor South Cove service. Boardings in the comparable land area, (north of Massachusetts Avenue, south of Essex station) are forecast at 9,500 daily revenue boardings in the "no build" compared with 18,500 for the Shawmut/Washington alternative and 26,000 for the relocated alignment. Because the already-constructed South Cove station would not be used in the "no build" alternative, the data is not totally comparable.

4.3.1.5.2 Ridership-South of Massachusetts Avenue

After the increment attributable to better core destination routing, the second major element in the higher ridership of the relocated alignment comes from the Jamaica Plain community. The market area for the proposed facility expands considerably to the west, covering much of Jamaica Plain. The network simulations show that some 4,000 Jamaica Plain and Parker Hill riders will save travel time by using the relocated Orange Line instead of the in-street operated Arborway Line. For many of these zones, the resulting travel time savings are considerable. A more complete discussion of the distribution of benefit and disbenefit resulting the Orange Line relocation is presented below.

The southern-most stations on the line experience travel time savings and consequent ridership growth in both the Shawmut/Washington tunnel option and the relocation alignment when compared with the base case. The ridership on the Shawmut/Washington facility would be comprised of slightly fewer Back Bay destined riders, and a somewhat greater number of retail core riders, based on the relative service levels offered.

As noted, the relocated Orange Line would offer significantly improved transit service to several thousand Jamaica Plain residents who would otherwise use the Arborway streetcar service. The effect on ridership for other lines is more complex. Concerning the Red Line, fewer than 1,000 daily riders would be diverted from the southern segment of Red Line system, primarily the Mattapan extension. Analysis reveals these riders to be largely Hyde Park users with Back Bay and Fenway destinations. However, when compared with the existing system, fewer than 1,000 riders would divert to the Inner Red Line stations. These are largely Roxbury and North Dorchester riders whose feeder bus routes allow connections to both the Orange Line and Red Line.

In addition to the Arborway diversions, the relocated Orange facility would attract some 5,500 one-way riders away from the "choke point" of the Green Line, between Copley and Park Street. The need for relief in this one small segment of Green Line system has been documented in several studies, most notably the MBTA's Central Area Systems Study, in 1969. That study examined the need for a third east-west downtown tunnel (i.e., in addition to the Relocated Orange Line) and concluded that an upgraded Green Line would be sufficient provided the CBD distribution function was shared with the Back Bay routing of the Orange Line.

The preceding paragraphs have dealt with the absolute magnitude and the make-up of the ridership for the three configuration options tested in the Environmental Assessment process. A more precise tool for analyzing the impact of a proposed transportation facility is the examination of the redistribution of travel times and service levels as a result of facility investment. The following section deals not with the absolute number of individuals using a facility, but rather with the differing service impacts experienced by the separate geographic market segments of the community.

4.3.1.5.3 User Benefit Comparisons

Of the three alignments examined in this study the Relocated Orange Line produces \$4.8 million of user benefit to the system over the base case, compared with \$3.1 for the subway alternative along the Shawmut and Washington Street. (The "no build is the base case.) This section will examine in detail the geographic distribution of benefits associated with the two "build" alternatives.

The geographic market area receiving travel time benefit from a full tunnel alternative under Shawmut Avenue and Washington Street is virtually the same market area served at present. Examination of ridership composition for this alternative shows very little diversion from competing transit lines when compared with base system. However, more South Cove riders would use the Orange Line in this alignment alternative than in the base case. The transportation impact of this alternative takes the form, then, of line haul time improvements brought about by the tunnel. These benefits would fall directly on the zones now using the Orange Line. No one particular area would suffer disbenefit, with the exception of the area immediately surrounding the existing Dover Street station. Increased levels of benefit would be spread rather uniformly throughout the existing service area, with increasing increments of service improvements occurring with increasing distance from downtown.

By contrast, analysis of the relocated Orange Line's transit service impacts in some detail is considerably more complex. When taken alone, (i.e., with no provisions for "replacement" services) the redistribution of transit travel time benefits (and disbenefit) is pronounced. The following paragraphs will show the change in user-benefits which would occur with relocation of the Orange Line with no replacement service assumed. Then, the data will be used to show level of user benefit resulting from certain replacement services.

As would be expected, the network accessibility calculations show absolute increase in user benefits for all zones south of Massachusetts Avenue which are to the west of the existing alignment, and a variety of positive and negative impacts to those zones to the east of the existing alignment. Starting from the south and working north, the zones feeding to Forest Hills and Green Street stations (zones 100, 101, and south) have improved travel times to downtown, and greatly improved travel to Back Bay. Zone 103 show a similar benefit, attributable to walk-ons at Boylston Street station. (See Fig. IV-16).

All the zones which now feed by bus to Egleston station have neither demonstrably improved nor worsened service. Feeder bus time will increase by approximately three minutes: however, line time to downtown from Jackson Square will be 2.8 minutes faster than from Egleston. Those 15% of downtown riders destined for Back Bay and South Cove will save an average 10 minutes time with the new alignment. Thus, for those zones which feed to Egleston in the present system, there will be a small increase in total benefit, not shared by all riders. These zones can be described as essentially unchanged.

North of Egleston, the occurrence of disbenefit, (or increased transit times) is revealed in networks which do not contain explicitly designed replacement services. Comparisons of transit travel times to downtown Boston between the existing Orange Line and with the Southwest relocation indicate that south of Massachusetts Avenue five zones served by the existing line will have net increases in travel time if the Orange Line is relocated. These are zones 74, 106, 107, 109, and 112, which are served by Dudley, and Northampton stations. In 1980 an estimated 5,000 daily riders from these zones would use the Orange Line in the "no build" option. This is more than one third of the total demand at the two stations. The downtown travel time increases suffered by the five zones would range from 1.7 to 6.3 minutes. An estimated 10 to 20 percent of the riders from these zones have destinations in the Back Bay area. For these trips the Relocated Orange Line would reduce total travel time by 0.3 to 2.0 minutes. The net disbenefit to riders from these four zones resulting from relocation of the Orange Line would be approximately $240,000 per year, of which 60 percent would be felt by zone 107 riders.

Within the South End, zones both to the east and west of the existing facility suffer accessibility loss when the Orange Line is relocated. In sum, zones north of Massachusetts Avenue will experience a net disbenefit of $286,000 per year of travel time differential. North of Massachusetts Avenue 20 travel zones served by the existing Orange Line would have increases in travel time to downtown Boston with the Southwest relocation of the Orange Line unless replacement service were provided. These are

zones 38, 39, 40, 41, 43, 704, 705, 706, 707, 709, 710, 711, 712, 714, 716, 717, 718, 719, 721, and 722. (Traffic Zones within Boston Proper are considerably smaller than in the rest of the region.) The travel time increases would range from 0.5 to 7.2 minutes from these zones. With the "no build" option these zones would contribute approximately 25 percent of all Northampton boardings and 80 percent of all Dover boardings, or a total of 2,600 daily riders. (See Fig. IV-16A).

Travel time impacts from a network which has no service on Washington Street north of Dudley are somewhat artificial in and of themselves, for some form of surface transit would be established along that corridor. (The Authority's improvement of bus service along Main Street in Charlestown with the relocation of the elevated is an example of such a precedent here.) For this reason, service characteristics of two such possible services are presented in Section 5.8. However, it should be emphasized that the stated user benefit for the relocated Orange Line ($4.8 million per year in 1980) does <u>not</u> assume any replacement service.

4.3.1.6 Orange Line Track Requirements

4.3.1.6.1 Analysis of Possible Express Track

A detailed analysis of the costs and benefits of providing an express track was conducted only for a relocated Orange Line extending to Route 128 in Needham. This alternative was determined to have less user benefit than a full local alternative. Fewer riders would use express service if the end of the Orange Line were at Forest Hills than if it extended to Route 128. Therefore, the user benefit of an express track would be even less with a Forest Hills terminal than with a Route 128 terminal. Although the current project is only for an Orange Line to Forest Hills, a decision on whether or not to ever provide an express track for rapid transit in this corridor must be made now in order to permit finalization of plans for upgrading of commuter rail and intercity rail service.

It would be expected intuitively that a service operated with an express track would have greater user benefit than a service operated with only local trains. For the demand distribution expected in the Southwest Corridor this is not the case. If all trains ran local from Route 128 to downtown, the headway would have to be sufficiently short to provide space for all passengers boarding at stations up to and including Massachusetts Avenue, where peak load would be reached. In the express option, neither the express nor the local trains would operate as frequently as trains in the all local case, so wait times would increase at all stations not served both by local and by express trains. During the peak period ,schedules on the entire Orange Line would be controlled by capacity requirements between Oak Grove and downtown Boston, because demand on that end of the line although lower over 24 hours, has a higher peaking factor resulting in greater peak demand. During the maximum hour the headway with four car-trains would have to be 3 minutes for reasonable load factors. On the south this service could be in the form either of local service to Route 128 every 3 minutes, or of local service to Forest Hills every 6 minutes plus express service to Route 128 every six minutes. During the remaining two hours of the peak period headways would be 4 or 5 minutes combined, and 8 or 10 minutes on each branch.

Assuming that the express track were in service three hours each morning and three hours each evening in the peak direction five days a week, annual operating costs would be reduced by $0.4 million per year compared to a full local service based on the schedule described above. Passengers boarding at stations from Route 128 to Forest Hills inclusive would experience run time reductions valued at $1.2 million per year with express service compared to full local service. However, they would also experience perceived wait time increases of $0.8 million per year. The remaining riders would experience no change in run times, but would experience perceived wait time increases valued at $0.6 million per year. Consequently provision of an express track would decrease overall user benefit of $0.2 million per year.

4.3.1.6.2 Conclusion - Orange Line Tracks

The construction of an additional Orange Line track in the project has been determined to be a somewhat marginal improvement to the transportation system. Because of severe right-of-way constrictions through the South End, the track could not continue north of Ruggles Street station. The travel time calculations reported in the above section assumed that the express trains would merge in with local trains at Massachusetts Avenue station. This assumption maximizes the possible running time advantage of the express train, and represents the 'best case' for the express track investment. However, the express trains would probably be operated only to Ruggles, where an extensive network of cross town bus connections and long-range circumferential transit are planned.

From a transportation standpoint, the most clear advantage of the express track would be its lower operating costs. In terms of user benefit, riders from Forest Hills and south would experience improved line times, while the inner stations would suffer from longer headways. (Boarders on the inner stations would have more chance to get a seat in the express option, however.) The resulting aggregate user benefit is slightly negative, with the outer line time savings not outweighing the inner waiting time losses. Other operating assumptions could alter these calculations to some degree: however, the principal conclusion remains that the express service would provide only a marginal improvement in total corridor travel quality for a substantial increase in capital cost.

4.3.2 Railroad Track Requirements

4.3.2.1 Existing Conditions and Planning Assumptions

This section addresses the issue of the number of tracks needed in the Corridor to adequately handle not only existing traffic but future AMTRAK and commuter rail traffic, relative to relocating the Orange Line into the Southwest Corridor and sharing the same right-of-way. This issue must also be viewed in light of the potential use of the Midland Division through Dorchester which can provide an alternative rail route between Readville and South Station. What follows is a review and analysis of the present and future track needs of this system relative to various track configuration. The results of this analysis show that a three-track system in the Corridor, along with one of the tracks of the Midland Division system would be needed to facilitate future combined high-speed and commuter-rail operations.

The existing Southwest Corridor track arrangement between Back Bay and Forest Hills consists of 4 railroad tracks used for intercity (AMTRAK) as well as for commuter rail services to Providence, Needham, Stoughton, and Franklin. Of these four the two center tracks are used almost exclusively for outbound* (track 1) and inbound (track 2) intercity and commuter rail trains. Track 4, easterly of tracks 1 and 2 is used for inbound commuter rail and local freight movements. Track 3, westerly of tracks 1 and 2 is used almost exclusively for inbound and outbound Needham commuter rail trains. The Needham branch diverts the main line right-of-way at Forest Hills.

The volume of traffic inbound during the heaviest hour of the morning peak (between 8:00 a.m. and 9:00 a.m.) is comprised of 9 inbound commuter trains arriving at South Station and 1 AMTRAK arrival. The corresponding outbound moves are comprised of 1 AMTRAK departure and 1 commuter train departure for Franklin. (See Fig. IV-17).

The use of the present 4 track system has evolved overtime when traffic volumes were somewhat higher than today's volume. For example in 1906, between 8:00 a.m. and 9:00 a.m., 18 inbound trains were operated.

At present there are 10 inbound arrivals into and 2 outbound departures from South Station in the heaviest traffic period between 8:00 a.m. and 9:00 a.m. If a two-track system is considered (one track exclusively for inbound movements and one track exclusively for outbound movements) and the existing schedule is used, the range of inbound headways would range between 2 and 9 minutes with an average of 5-1/2 minutes. If these trains were scheduled at uniform headways, that headway would be 6 minutes.

The feasibility of operating present trains for one hour at uniform headways of 6 minutes, is based on an estimated safe stopping time-distance of 3 minutes from 90 mph. This is also the time-distance needed to avoid being slowed by yellow block signals, based on existing signal spacing. On a 6-minute headway, these trains could not be more than 3 minutes late before they would begin to conflict with each other through the signal system.

Assumptions for future intercity service in additon to the commuter trains are determined by an agreement which was made between AMTRAK and the MBTA which allows room to operate up to 4 trains per hour per direction.

These assumptions proved to be a critical factor in the evaluation of track needs in the Southwest Corridor. On the pages that follow, the analysis documents the possibility of running several different schedule assumptions over two-, three- and four-track segments. In each case, the need for high-speed trains to have one inbound track primarily reserved for their operations emerges as the controlling variable in the analysis. If it were assumed that some AMTRAK trains could skip Back Bay station, and use the Midland Division, then the conclusions for the Southwest Corridor regarding rail requirements would be somewhat different. However, in this analysis, the continuation of service to Back Bay station (which AMTRAK views as a critical market area) has been assumed consistent with the provisions of the purchase and sale agreement for the Corridor right-of-way. This is consistent further with the joint understanding of the Commonwealth of Massachusetts and the Federal Railway Administration.

---

*Outbound means south (west) from Boston.

4.3.2.2 Creation of 1980 Schedules

In a process described in Appendix C two 1980 demand forecasts were made for the system. These forecasts were used to create train schedules which would supply adequate capacity consistent with the improved access time (improved headway) assumptions used in the forecasting process.

As a first step, present supply characteristics were examined to be used as a guideline in the creation of an "improved" 1980 commuter-rail schedule. Detailed ridership and train descriptions from 1974 revealed a per-vehicle occupancy factor of 79 passengers for both Budd RDC cars and standard coaches, between 7:30 and 9:00 a.m. at Back Bay. This represents an average load factor of 90 percent. Present average train length was calculated at somewhat above 5 cars (5.33).

The 30 percent and 40 percent increased ridership estimate can then be translated into train requirements by employing 1974 commuter-rail system operating characteristics to develop a description of the commuter-rail system needed to serve this estimated demand increase (see Fig. IV-18). By retaining the average 5-car train length and 79 passengers per car estimate, the headways and train lengths shown in Fig. IV-18 could be utilized to carry 1980 volumes with general operating productivity characteristics similar to those of today.

4.3.2.3 Creation of 1990 or "Maximum Case" Schedules

For the 1990 case, desirable supply characteristics were established jointly by CTPS and the MBTA Commuter Rail Directorate. Service levels agreed upon called for service every fifteen minutes in the peak hour on each of the branches presently served. Additional service was agreed upon every fifteen minutes from station 128. Demand patterns revealed in the 1980 data were manually extrapolated to 1990. It was concluded that the basic pattern of five-car trains was consistent with the long-term demand in most operations. However, precise demand forecasts were not made to compute the actual length of each train in the schedule proposed. Headways were found to be reasonably consistent with both present train length, and service levels desired for 1990 and beyond. As in the previous step, positions were "reserved" for four AMTRAK trains per hour. Schedules were created with and without an improved Needham commuter rail service.

The 1990 schedules define 24 inbound trains per hour as the "maximum" rail utilization option. No explicit effort has been undertaken to forecast the exact headway needs of each branch. For example, in the maximum rail case, Needham commuter-rail service might be operated with six trains per hour, rather than four AMTRAK with two rather than four tracks. The figure of 24 trains per hour, therefore, should be considered as the basic description of the 1990 maximum rail condition, rather than the exact allocation of trains among branch services planned at this point.

As a result, 1990 and beyond schedules were established as follows:

	Peak Hour Arrivals at Back Bay	
Needham	4	(15 minutes headway)
Franklin	4	
Stoughton	4	
Providence	4	
128	4	
AMTRAK (given)	4	
	24	

This schedule, (with train lengths unspecified) was established as a reasonable maximum service schedule for long-term corridor planning. Branch service is provided on quarter hour headways, while the combined Main-Line service through the 128 Park-Ride facility would be as low as 5 minutes, on average. The schedule represents a reasonable maximum.

4.3.2.4 Examination of Alternatives

Each of the alternative track options was examined in terms of theoretical capacity, and in terms of probability of schedule reliability. Each option was so examined in the time frame of 1980 and 1990, both with and without Needham CRR service assumed. Primary attention was paid to the issues surrounding the combined operation of high-speed inter-city railroad service with standard commuter rail equipment.

The decision to propose three railroad tracks between Forest Hills and Back Bay with an additional railroad track on the Midland Division was made jointly by the MBTA, EOTC, AMTRAK, and the Federal Railroad Administration after an extensive analysis of known and projected requirements in the corridor. The FRA has undertaken detailed supply simulations which document the track requirement of inter-city services, and the potential for shared operations with local service. The MBTA Commuter Rail Directorate has also performed analyses of regional rail requirements, and compatibility with high-speed rail services. This section of the Environmental Impact Statement presents a greatly summarized description of the salient conclusions of those studies.

The three-track option has been examined in the context of all the schedules prepared for the 1980 and 1990 timeframes, with and without CRR service to Needham.

4.3.2.5 Three Tracks, Compared with Two Track Option

1980 - without Needham. From the point of view of theoretical capacity, three tracks would not be required to handle the CTPS 1980 railroad schedule. Allowing 6 minutes headway for each of the agreed-upon AMTRAK four-trains-per-hour, the nine CRR trains would operate on a average 4-minute headway. Given that the present signal system gives a full green after a 3.3-minute block, the four-minute headway is within the theoretical range of capacity. (If only two AMTRAK trains were operated, the nine CRR trains would operate at approximately 5-minute headways.)

From a reliability standpoint, the intermixing of long-distance service with CRR frequencies of 4 minutes raises serious facility management questions. The maintenance of the 4-minute headway would require considerable effort, given the number of variables affecting railroad reliability, (e.g. station dwell times, grade-crossing management). The differential between the signal timing and the headway provides only minimal opportunity for "correcting" a schedule which has become out of phase. If a train were over 40 seconds late, the first following train would be affected. If the first train were 80 seconds late, the scheduled performance of the first and second following trains would be affected. There would be a potential ripple effect throughout the peak hour service. These rough calculations serve to demonstrate the nature of service reliability under close headway conditions for the CRR trains themselves.

Maintenance of the schedule discussed here is made considerably more difficult when there is joint operation with long distance rail over a single inbound track. Operation of the majority of the service on headways with less than one minute as a recovery factor, is largely incompatible with inter-city rail services.

Three tracks are required to give the flexibility needed in scheduling the inter-city and the commuter rail system with the associated speed differentials.

In short, the minimum service schedule analyzed in this Environmental assessment, (consistent with stated constraints concerning agreed-upon AMTRAK service) could be operated over a two-track SW project segment, but with a considerably increased factor of unreliability over present operations. Even with the minimum schedule analyzed, a three-track right-of-way would be highly desirable in order to separate inter-city trains from commuter operation.

1980 - with Needham. One inbound track would be inadequate to carry 13 CRR trains per peak hour, plus the agreed-upon four AMTRAK trains. Assuming, again, a 6-minute block for the AMTRAK service, CRR operations would average under 2.8 minutes headway. This is not consistent with present technology assumptions. A three-track facility would be required by the CTPS 1980 CRR schedule which includes Needham.

1990 Schedules. The two-track option would be insufficient for the requirements of the "maximum" 1990 CRR schedule, with or without Needham CRR service.

4.3.2.6 Three Tracks Compared with the Four-Track Option

1980 - without Needham. The three-track option would be sufficient to operate the CTPS 1980 CRR schedule without Needham, from the viewpoint of both theoretical capacity and margin of error for reliability. If the AMTRAK inbound services were operated on an exclusive track, the nine CRR trains in this scenario would have average headways of over 6.5 minutes which incorporates a generous recovery factor of over 3 minutes in each interval. In the event of breakdown in either direction, the third track could be used to by-pass disabled equipment.

1980 - with Needham. A three-track facility would be sufficient for the CTPS 1980 CRR schedule including Needham service. Assuming that four of the 13 CRR trains shared the high-speed track with the inter-city service, no trains on the corridor would need to have closer than a 6.5-minute interval.

Again, under emergency conditions, trains could be re-routed to the third track to avoid breakdowns, or other unforeseen situations.

1990 - without Needham. In this planning scenario, the three-track section of the proposed Southwest project would be sufficient to handle the 16 CRR trains in addition to the four AMTRAK trains. The proposed three-track section between Forest Hills and Back Bay and South Stations would accommodate the CTPS 1990 CRR schedule "without Needham" with considerable room for flexibility of operation. Additional tracks would be desirable between Readville and 128 in both 1990 options. As is similar to the above case, the average headway would not need to go below 6 min. on either track between Forest Hills and Back Bay.

1990 - with Needham. In the "maximum" rail option a total of 24 trains would operate inbound during the 1990 peak hour. If eight Main Line CRR trains shared the high-speed track, 5-minute headways would exist on that track. The remaining 12 inbound trains would utilize a common track at an average 5-minute headway.

The MBTA Commuter Rail Directorate has undertaken an extensive examination of the adequacy of the three-track proposal for a 1990 maximum schedule. This analysis shows that in the peak period there would be twelve outbound movements through the corridor, in addition to the twelve inbound movements per track assumed in the maximum schedule. The maximum schedule, therefore, could be accommodated with average headways of 5 minutes throughout the project.

4.3.2.7 Conclusion Three Railroad Tracks

The examination of the ability of the proposed three-track project to accommodate each of the schedule scenarios has shown that the three-track option is highly desirable in the most moderate of the forecasts, and fully adequate in the most optimistic of them. Even in the 1980 "without Needham" schedule, the enforced mixing of commuter rail operations with intercity operations that would be caused by the two-track (one in-bound) option would result in an inflexible and unreliable service. The provision of the separate track, allows additional facilities management options which are desirable in any circumstance.

Extensive negotiations between the Commonwealth and the Federal Railway Administration have resulted in an agreement that the provision of three railroad tracks between Forest Hills and South Station is an essential element in the Southwest Corridor project. This option has been found to be adequate to accommodate all foreseen growth in both metropolitan and inter-city demand for services.

4.3.3 Arterial Street Concepts

It is intended that the arterial street be designed as a "Parkway" or Boulevard" with appropriate landscaping and pedestrian amenities. The street, if constructed would compliment the proposed Greenbelt component of the Southwest Corridor Project.

The concept identified for arterial street improvements in the Southwest Corridor is to make effective use of the land previously acquired for highway purposes for Interstate 95. This would limit the location of any arterial street development to a specific area extending from the intersection of Columbus Avenue at the new crosstown arterial to Forest Hills parallel to the railroad right-of-way to Forest Hills.

Many different arterial street configurations would be possible within this area. The specific design and location details would vary according to the rail/transit options. Section 4.4 offers a more detailed description of the specific alternatives evaluated in this analysis.

At the Southwest Corridor Public Hearing on July 15 and 16, 1976, it was suggested that the Arterial Street be extended to V.F.W. Parkway; or Turtle Pond Parkway; or other points South of Forest Hills. Decisions made by the Governor of the Commonwealth in 1972, subsequent to the extensive analysis of the Southwest Corridor by the Boston Transportation Planning Review (BTPR), preclude extensions of the proposed arterial southerly beyond Forest Hills.

The BTPR examined a series of roadway facilities, from a full expressway and a "managed" expressway to an arterial from Massachusetts Avenue to Jackson Square or Forest Hills, and a "no build". The Southwest Corridor E.I.A. examined these latter three options in detail, building upon the previous work of the BTPR Draft E.I.S. and it is intended that the current E.I.S. bring the matter of arterial facilities in the Southwest Corridor to a close.

The project is intended to maintain the existing scale of the surrounding street network in the areas through which it passes. The design plans for the arterial, if it is to be constructed, will follow FHWA and Mass. DPW procedures and it is intended that its details be designed to reinforce the residential areas and are conducive to pedestrian safety. A median will be preserved in the Ruggles Street to Jackson Square section of the arterial street and left-turn lanes will be included at major intersections. Street layout dimensions

and details will be in keeping with urban traffic speeds of 25 and 35 miles per hour. Testimony at the Public Hearing noted that street dimensions, alignments and channelization should be consistent with pedestrian access along the Corridor. It was also stated that street widenings, right turn channelization and other alignment devices designed to speed up traffic should be eliminated. These issues will be further discussed during the design phase of the arterial street component of the project if that component is to be constructed. Design would be according to FHWA and Mass. DPW procedures.

The arterial street would probably be maintained as an ordinary city street by the City of Boston. Day-to-day maintenance would be borne by City real estate tax payments. Alternatively, the street would be maintained by the Mass. DPW. Some offset of this cost would be expected due to the reduction of traffic on other local streets such as Centre, Washington, Lamartine and Amory. The costs of removal of the Elevated and sidewalk repair on Washington Street would be borne by MBTA as part of the Southwest Corridor Project. The cost of construction of the Arterial would be borne by the Massachusetts Department of Public Works with appropriate Federal reimbursement.

4.4 Description of Project Alternatives

A wide variety of alternatives (as well as options within alternatives) were investigated during the study process. Of the alternatives discussed here, the rail/transit facilities and the Arterial Street have a particular set of options within each section of each project area.

The rail/transit options studied between Camden Street and Forest Hills, for example, deal with the depression or modification (higher and wider) of the existing Penn Central embankment. The Arterial Street options are concerned with being East or West of the rail facilities in this area, south of Jackson Square. Additionally, the possibilities of not building either or both facilities exists as well as building portions of the Arterial.

Between South Cove and Camden Street, two alternatives are presented. One would be several feet below existing grade for the combined rail/transit facility. The other studies an Orange Line tunnel to the vicinity of Dartmouth Street. The Arterial Street is not a part of the project in this area.

The facility studies for rail/transit, stations and the Arterial Street were made so that, where feasible, various compatible elements could be combined. Fig. IV-19 shows that a large number of combinations are possible. The alternatives studied and their designations are shown in Figure 102.

In order to simplify understanding of the project alternatives, alternatives which exist within each of two boundaries are described. The two boundaries are: South Cove to Camden Street and Camden Street to Forest Hills.

All other alternatives studies are described in Section 4.5 with references to Appendix F.

The details, dimensions, and facility configurations described in Sections 4 and 5 represent reasonable design concepts attainable in this project. Final design will reflect later information resulting from in-depth studies and may dictate details, dimensions and facility configurations other than those described.

For the sake of brevity in this Environmental Impact Statement, certain drawings which appeared in the original Environmental Impact Analysis have been removed. The plan information (alignment and parcel numbers) is similar to the drawings of PHP-1 and PHP-2, although not identical. Profile information for all alternatives has been consolidated on the PHP-1 and PHP-2 drawings. Representative sections of several alternatives have been included in this Statement. Because the scale of the sections makes minor differences in elevation indistinguishable, the Post-Hearing Profile is not illustrated by separate section drawings but falls in between those of the Full and Modified Depression. The Station Drawings included are appropriate for all Depressed configurations, with or without the Arterial Street as indicated. A correlation of the plan sheets listed in the text is shown in Fig. 19A.

4.4.1 Alternative N.B.-1 South Cove to Forest Hills No-Build Rail Transit, No-Build Arterial Street

4.4.1.1 Existing Orange Line

The existing Orange Line from Haymarket Square station to Forest Hills station is 5.8 miles long consisting of 1.1 mile of tunnel and 4.7 miles of elevated structure. There are 10 stations within the length, four in the tunnel and six on the elevated sections.

Under the No-Build Alternative, the following would result:

- The Orange Line will remain on the elevated structure.
- Only normal maintenance would be performed.
- No platform lengthening would be constructed, thereby restricting the system to four 65-foot car trains.
- Dudley Station track work modifications would be completed to accommodate 65-foot cars.

4.4.1.2 South Cove Project

The completed section of the South Cove project consists of a two-track tunnel section, fifteen hundred feet long, extending from a point approximately one hundred feet north of Kneeland Street to the intersection of Marginal Road and Shawmut Avenue.

Under the No-Build Alternative the following would result:

- The transit facility would be constructed and operated to South Cove station and to a station just east of existing Back Bay Station.
- Back Bay railroad station would remain unchanged.

4.4.1.3 Amtrak

The Amtrak system now uses the Penn Central trackage for intercity service and has entered into an agreement with the Commonwealth to allow particular levels of future service. No-build alternatives considered, therefore, would not prevent Amtrak related improvements from being undertaken.

4.4.1.4 Commuter Rail

Commuter rail presently uses the Penn Central trackage for local commuter service.

Under the no-build alternative, commuter rail upgrading would proceed as defined by the MBTA's continuing commuter rail improvements program (CRIP).

4.4.1.5 Arterial Street

A no-build alternative for the arterial street would mean that only normal maintenance or improvements of the existing streets would take place.

4.4.2 Alternative SC-1, South Cove to Camden Street - With Minimum Grade Adjustments to all Tracks (FIG. IV-63, IV-64 and IV-65)

Alternative SC-1 consists of a rail/transit facility extending from the portal of the proposed South Cove tunnel in the vicinity of Arlington Street to Camden Street a distance of 1 mile.

Throughout the length of this portion of the project the rail/transit facility will be either in a depressed section or at grade allowing a minimum of 17'-8" overhead railroad clearance. No bridges or viaducts are anticipated to carry the transit or railroad. The existing station site at Back Bay will be utilized and a new site will be used for a station at Massachusetts Avenue.

The proposed relocated Orange Line will pass through an area largely residential in nature which spans from Back Bay station to Northeastern University. A short section of business oriented property is located between Columbus Avenue and Back Bay Station on the northerly side of the Massachusetts Turnpike.

The proposed alternative would connect with the Orange Line facilities planned for the South Cove area and would not require any alignment changes to that project. As part of the South Cove Tunnel Extension Project, the existing tunnel would be extended from its present terminal point in the vicinity of Shawmut Avenue and Oak Street under Marginal Road in South Cove, under the Massachusetts Turnpike, under two Boston and Albany tracks, under the Tremont-Street -Arlington-Street Bridge ascending to a location approximately 350 feet west of Arlington Street. The tunnel would surface between the two existing Boston and Albany tracks and the three new Penn Central Shore Line tracks located parallel to the Massachusetts Turnpike

East of the proposed portal the Boston and Albany and the Penn Central tracks diverge in order to provide sufficient width to accommodate seven tracks at the tunnel portal.

The Boston and Albany tracks west of the portal would be rebuilt in approximately their original location. The new trackage would merge with the existing track at Dartmouth Street.

4.4.2.1 Back Bay Station Area (Fig. IV-64)

At Back Bay station, the two proposed Orange Line tracks and three shared Amtrak and Commuter Rail (Railroad) tracks would be aligned so as to allow for a center platform rapid transit. The Railroad facility would be provided with both side and center platforms.

Upgrading of the Boston and Albany line (B&A) to provide high platforms is not under consideration, but allowances have been made in the station layout for future upgrading.

Overall station dimensions utilized provide for 410 feet long Orange Line platforms of variable width (18 to 23'), on 1° curvature (R = 5730'), (center and side), each 1200 feet long. The center platform would vary in length from 24 to 16 feet. The side platform would have a minimum width of 12 feet. Maximum horizontal track curvature for both the side and center platform would be 1/2° (R = 11,460').

The combined width of 7 tracks and platforms in the Back Bay area require: the rebuilding of Back Bay Station; rebuilding of 3 bridges; the demolition of 8 buildings in the South End; underpinning of the 6-story, reinforced concrete Heath building at 285 Columbus Avenue; the removal and reconstruction of approximately 2000 feet of granite wall; and the reconstruction of Buckingham Street.

4.4.2.2 South of Back Bay Station (FIG. IV-63 and IV-64)

The rapid transit and rail tracks would be aligned within the existing Penn Central right-of-way south and west of Back Bay Station. The cross-sectional width required in this area is 70 feet as illustrated in Fig. IV-68B. The horizontal alignment is on a tangent section between Yarmouth Street and Ruggles Street. In Yarmouth Street area the tracks are approximately 5 feet below the grade of the surrounding terrain while the grade of the tracks is 0.0 percent. Five tracks would be located in the rail/transit corridor from Back Bay Station to Forest Hills Station.

Structures in the section between Back Bay Station and the proposed Massachusetts Avenue Station include a vehicle bridge at Dartmouth Street a foot bridge at Follen Street/Braddock Park, a vehicle bridge at West Newton Street, a foot bridge at Durham Street/West Rutland Square and a vehicle bridge at Massachusetts Avenue which would be replaced. The proposed Massachusetts Avenue Station would be located adjacent to and west of Massachusetts Avenue with access at both Massachusetts Avenue and Gainsborough Street. The tracks at the Massachusetts Avenue area would be 2

feet below the surrounding area. The grade on the tracks through this section would be 0.0 percent to accommodate the station platform. The foot bridge located at Gainsborough Street/Camden Street would be rebuilt as part of the Massachusett Avenue Station.

There would be five tracks at Massachusetts Avenue Station, three railroad and two transit. The railroad tracks would be on tangent alignment and located on the easterly side of the corridor. The inbound transit track would be on tangent alignment and the outbound transit track would be constructed on an alignment consisting of two reversed curves and a tangent section designed to accommodate the 410 foot platform.

Structures to be constructed under the SC-1 Alternative include:

Berkeley Street Bridge
Columbus Avenue/Clarendon Street Bridge
Buckingham Street
Dartmouth Street Bridge
Follen Street (footbridge)
West Newton Street Bridge
Durham Street (footbridge)
Massachusetts Avenue Bridge
Camden Street (footbridge)
Back Bay Station

Alternative SC-1 requires the demolition of eight buildings, Back Bay Station and one shed. Additionally a multi-story building would require underpinning.

4.4.3 Alternative SC-2, South Cove to Camden Street with Orange Line in Tunnel to Dartmouth Street (See Fig. IV-66, IV-67 and IV-68)

Alternative SC-2 consists of a cut-and-cover tunnel extending from the terminus of the South Cove tunnel to Dartmouth Street and a combination semi-depressed and at-grade facility from Dartmouth Street to Camden Street.

Throughout this section the existing tracks would be adjusted to provide for 17'-8" vertical clearance. No bridges or viaducts are anticipated to carry the transit or the railroad. The existing site of Back Bay Station would be utilized for the proposed new Back Bay Station while the proposed Massachusetts Avenue Station would be on new site located between Massachusetts Avenue and Camden Street.

The proposed relocated Orange Line would pass through a primarily residential area which extends from Back Bay to Northeastern University. A short section of business-oriented property is located between Columbus Avenue and Back Bay Station on the northerly side of the Massachusetts Turnpike.

This alternative would connect with the Orange Line facilities planned for the South Cove area and would not require any alignment changes to that project. As part of the South Cove Tunnel Extension Project, the existing tunnel would be extended from its present terminal point in the vicinity of Shawmut Avenue and Oak Street under Marginal Road in South Cove, under the Massachusetts Turnpike, under two Boston and Albany tracks, under the Tremont-Street-Arlington-Street Bridge to a point approximately 100 feet west of Arlington Street. Under alternative SC-2, the transit facility would be carried in a twin-box cut-and-cover tunnel from that point, along the Penn Central right-of-way on a tangent alignment approaching the Bay Back Station area. The tracks in this section would be on an ascending 0.5% grade and would be approximately 21 feet below the grade of the existing railroad tracks. (See Fig. IV-68).

4.4.3.1 Back Bay Station Area (Fig. IV-67)

At Back Bay Station the transit-tunnel alignment would be on a 14.3° (R = 400') curve to the left approaching the station-platform area which would be on tangent. The transit platforms would be located one leve below the Amtrak and commuter-rail platform which would be one level below existing streets. A system of escalators and elevators would be utilized to transfer patrons from one level to another. The transit station would have two 410 foot side platforms.

The Boston & Albany Railroad platform would be center loaded, varying in width from 24 feet to 12 feet. The two Amtrack and commuter platforms wold be 1200 feet long and serve three tracks.

The transit facility would be on an ascending 0.5 percent grade through the Back Bay Station area and the railroad grades through the station area would be 0.5 percent.

4.4.3.2 South of Back Bay Station (Fig. IV-66 and IV-67)

South of Back Bay Station the transit facility, still in a cut-and-cover section, curves left on a 143° (R=400') curve and is aligned with the existing rail on the westerly side of the existing tracks. The transit tunnel portal would be located 175 feet south of Dartmouth Street. The tracks would be in a semi-depressed section from the portal to a point 1300 feet south, constructed on a 0.0 percent grade. Beyond the semi-depressed section, the transit and rail tracks would be constructed on a 0.5 percent grade, essentially at-grade into the proposed Massachusetts Avenue Station.

The proposed Massachusetts Avenue Station would be located adjacent to and south of Massachusetts Avenue with access at both Massachusetts Avenue and Gainsborough Street/Camden Street. The tracks at the Massachusetts Street area would be 2-5 feet below the surrounding area. The grade on the tracks through this section would be 0.0 percent. The foot bridge located at Gainsborough Street/Camden Street would be rebuilt as part of the Massachusetts Avenue Station.

There would be five tracks at this location, three railroad and two transit. The three railroad tracks would be on tangent alignment through the station area with no platforms provided. A center platform would be provided for the two transit tracks. The inbound track would be on tangent alignment in this area and the outbound track alignment consisting of a reverse curve, short tangent and a reverse curve to accomodate the proposed 410 foot platform.

Structures to be re-built under the SC-2 Alternative include:

- Berkeley Street Bridge
- Columbus Avenue/Clarendon Street Bridge
- Buckingham Street
- Dartmouth Street Bridge
- Follen Street (footbridge)
- West Newton Street Bridge
- Durham Street (footbridge)
- Massachusetts Avenue Bridge
- Camden Street (footbridge)
- Back Bay Station

This alternative would require the demolition of two buildings and Back Bay Station.

4.4.4 Alternative FH-1, Camden Street to Forest Hills - Depressed Rail/Transit - No Arterial Street (Figures IV-20 thru IV-26)

Beyond Northeastern University the area is predominately residential with the exception of two areas of industrial development; one, west of the tracks between Prentiss Street and Heath Street and the second on the east side of the track between Williams Street and Forest Hills. From Walpole Street to Forest Hills, the land abutting the Penn Central right-of-way is, to a varied degree, cleared. Much of the land was cleared for the proposed, but now abandoned I-95 South.

The alignment of the rail/transit facility for the section between Camden Street and Ruggles Street would be on a tangent section which would follow the existing Penn Central alignment (see Fig. IV-25 and IV-26). The proposed profile for that section would, after an initial 1 percent grade, consist of a series of flat grades which would maintain a relatively constant depth of section approximately 20 feet below the grade of the existing terrain. Sections for this area are similar to those shown on Fig. IV-33A. Ruggles Street Station, as proposed, would be located north of Ruggles Street.

South of the proposed Ruggles Street Station, the rail/transit facility would be continued on a tangent section to Station Street where it curves left on a 1.4° (R= 4000') curve to New Heath Street where a 700 foot tangent section begins. The tangent section continues to Relocated Heath Street where a 1.4° (R=4000') curve to the right begins and continues through Jackson Square. The rail/transit facility in this section would be completely within the existing right-of-way (see Fig. IV-24, IV-25 and IV-26).

In the section between the proposed Ruggles Street Station and Jackson Square the rail/transit facility would remain in a depressed section utilizing a relatively flat-grade profile to maintain a uniform section approximately 20 feet below the surrounding existing ground. Within this section, the impact of the depressed section would affect the local streets which presently pass under the railroad. Under this alternative local streets would cross above the tracks. The local streets affected by this alternative would be Ruggles Street, Prentiss Street, Station Street, Tremont Street, New Heath Street and Heath Street. Fig. IV-33A illustrates the location of rail/transit facility relative to the surrounding terrain.

Roxbury Crossing Station would be located at Tremont Street and Jackson Square Station would be located between Heath Street and Centre Street.

Jackson Square to Forest Hills, a distance of 1.8 miles will be the final section of the proposed Orange Line relocation although certain station studies indicate additional work would be required south of Forest Hills to transition the new railroad track grades back to existing.

South of Jackson Square, the horizontal alignment continues on a 1° (R=5730') curve to the right to the vicinity of Roys Street where a tangent section begins and extends to Hoffman Street. The alignment then curves left on a 1° (R=5730') curve through the Boylston Street Station area to a point a few hundred feet south of Hubbard Street. A 600-foot tangent section extends to Minton Street where the alignment follows a 1° (R=5730') curve to the right to Gordon Street. South of Gordon Street the alignment would be on tangent to William Street where a 1° (R=5730') curve to the left extends to McBride Street. From McBride Street to the Forest Hills Station area the horizontal alignment would be in a tangent section (see Fig. IV-20, IV-21 and IV-23). The rail/transit facility in this area is in a depressed section approximately 20 feet below the grade of the surrounding terrain (see Fig. IV-33A). The profile in this location would have maximum grades of 0.6 percent with 0.0 percent grades at the proposed station location.

The proposed stations in this section are Jackson Sqaure Station located between Heath Street and Centre Street, Boylston Street Station located at Boylston Street, Green Street Station located at Green Street and Forest Hills Station located south of Morton Street.

Streets to be bridged over the transit/rail facility in this section include Mozart Street, Paul Gore Street, Boylston Street, Minton Street, Green Street, Williams Street, McBride Street and Morton Street.

Construction on local streets under this alternative will be limited to the areas around the proposed stations and any work necessitated by the replacement of railroad bridges over local streets.

The station proposed for Forest Hills under the depressed rail/transit alternatives (FH-1 and FH-2) would be designed with the tracks located an an elevation 30 feet below the level of the tracks as they presently exist. The grade of the tracks from the north through the station would be 0.5 percent ascending south followed by a 1 percent grade also ascending south. The concept of having the rail/transit tracks in a depressed section through the station area would necessitate extending the railroad tracks approximately 3000 feet south before the existing grade could be met.

4.4.5 Alternative FH-2, Camden Street to Forest Hills - Depressed Rail/Transit Arterial Street East (Figures IV-27 thru IV-33)

4.4.5.1 Alternative FH-2 is essentially the same as FH-1 with the addition of the arterial street. The section between Camden Street and Ruggles Street is on a tangent alignment completely within the existing Penn Central right-of-way. The proposed profile for the section between the Massachusetts Avenue Station and the Ruggles Street Station will, after an initial 1 percent, consist of a series of flat grades which will maintain a relatively constant depth of section (see Fig. IV-32 and IV-33). A typical depressed section for this area is shown on Fig. IV-33A. Ruggles Street Station as proposed will be located north of Ruggles Street.

South of the proposed Ruggles Street Station the rail/transit facility would be constructed on a tangent section to Station Street where it curves left on a 1.4° (R=4000') curve to New Heath Street where a 700-foot tangent section begins. The tangent section continues to Relocated Heath Street where a 1.4° (R=4000') curve to the right begins and continues through Jackson Square. The rail/transit facility in this section would be completely within the existing right-of-way. The facility would remain in a depressed section utilizing a relatively flat-grade profile to maintain a uniform section. In this section, Ruggles Street to Jackson Square, the impact of the depressed section would affect the local streets which presently pass under the railroad, but under this alternative would cross above the tracks. The local streets affected by this alternative would be Ruggles Street, Prentiss Street, Station Street, Tremont Street, New Heath Street and Heath Street. Roxbury Crossing Station would be located at Tremont Street and Jackson Square Station would be located between Heath Street and Centre Street (see Fig. IV-31, IV-32 and IV-33).

4.4.5.2 An arterial street system was developed in conjunction with the Orange Line Relocation as part of the Southwest Corridor Study. The arterial street system was developed for the purpose of eliminating through traffic from the local residential streets in the area and to provide better traffic circulation in the proposed station areas. The route of the proposed arterial street would essentially follow the route cleared for the abandoned I-95 South (see Fig. I-3).

The Arterial Street was broken into three segments:

Segment one: That part of the Arterial Street route from the Southeast Expressway ramps at Massachusetts Avenue to Ruggles Street. (see Section 1.2.3)

Segment two: From the end of segment one at Ruggles Street along the easterly side of the Penn Central tracks to Jackson Square.

Segment three: From the end of segment two at Jackson Square along the easterly side of the Penn Central tracks to Mozart Street. From Mozart Street there is an option to either continue the Arterial Street on the easterly side of the track to Forest Hills or to cross over the tracks and locate the Arterial Street on the westerly side of the tracks and terminate at Forest Hills.

The section of corridor defined as Segment two (Ruggles Street to Jackson Square) has an existing Arterial Street system consisting of Columbus Avenue and Tremont Street one block apart at Ruggles Street and converging at Roxbury Crossing with Columbus Avenue continuing on to Jackson Square. Segment two is approximately one mile in length.

The route is generally defined as: beginning at Tremont Street at Sterling Street. The alignment curves southerly across Tremont Street at Weston Street and is generally aligned with the Penn Central tracks as Ruggles Street. From Ruggles Street to Jackson Square, the Arterial Street is parallel and adjacent to the easterly side of the Penn Central tracks. South of Jackson Square the alignment is still parallel and adjacent to the Penn Central tracks but with the option of being east or west of the tracks and terminating at Forest Hills.

The Arterial Street proposed for Segment two is a six-lane arterial beginning at Ruggles Street located parallel to and east of the Penn Central alignment (see Fig. IV-31 thru 33). The Arterial Street will closely follow the Penn Central alignment which in this area is almost totally on a 1.4° (R=4000') curve.

The roadway cross section for Segment two could consist of a sidewalk with a planting strip, a parking lane, three travel lanes in each direction divided by a median. Variation in the median width at intersections for the purpose of accomodating left turns are possible. The location of the left turn storage lanes would be determined in the design phase. At the back of the sidewalk provisions would be made for continuous open space and green belt landscaping where feasible. A pedestrian drop area or kiss-and-ride slot would be provided for the Arterial Street at Roxbury Crossing Station. The major intersections, Ruggles Street, Tremont Street, Heath Street and Centre Street would be signalized.

Segment two of the proposed arterial street can be designed and constructed to function properly without Segment three (see Fig. IV-31A).

Jackson Square to Forest Hills, a distance of 1.8 miles would be the final section of the proposed Orange Line Relocation although certain station studies indicate additional work will be required to be done south of Forest Hills to allow a transition of the new railroad track grades back to existing.

4.4.5.3 South of Jackson Square the horizontal alignment continues on a 1.4° (R=4000') curve to the right to the vicinity of Roys Street where a tangent section begins and extends to Hoffman Street. The alignment then curves left on a 1° (R=5730') curve through the Boylston Street

Station area to a point a few hundred feet south of Hubbard Street. A 900-foot tangent section extends to Minton Street where the alignment follows a 1° (R=5730') curve to the right to Gordon Street. South of Gordon Street the alignment would be on tangent to William Street where a 1° (R=5730') curve to the left extends to McBride Street. From McBride Street to the Forest Hills Station area the horizontal alignment would be in a tangent section (see Fig. IV-27, IV-28 and IV-30). The rail/transit facility in this area is in a depressed section approximately 25 feet below the grade of the surrounding terrain (see Fig. IV- 33A) The profile in this location will have maximum grades of 1 percent with 0.5 percent grades at the proposed station location.

The proposed stations in this section are Jackson Square Station located between Heath Street and Centre Street, Boylston Street Station located at Boylston Street, Green Street Station located at Green Street and Forest Hills Station located south of Morton Street.

Streets to be bridged over the transit/rail facility in this section include Mozart Street, Paul Gore Street, Boylston Street, Minton Street, Green Street, Gordon Street, Williams Street, McBride Street and Morton Street. A pedestrian bridge will be constructed at Cornwall Street.

4.4.5.4 An Arterial Street, Segment three, was developed in conjunction with the Jackson Square to Forest Hills section of the rail/transit facility. Beginning at Jackson Square, the southerly limit of Segment two, the Arterial Street, if extended, transitions from a six-lane divided roadway to a four-lane undivided roadway. The horizontal alignment closely follows the rail alignment on the easterly side of the tracks. At the southerly end of Segment three, the Arterial Street transitions into the local street pattern at Forest Hills, intersecting Morton Street at Hyde Park Avenue on the easterly side of the tracks.

A roadway cross section in Segment three consists of a 10-foot sidewalk, four 12-foot travel lanes and a 10-foot sidewalk. A pedestrian drop area or kiss-and-ride slot will be provided for on the south-bound side of the arterial at the proposed Boylston Street Station.

4.4.6 Alternative FH-3 , Rail/Transit On Modified Embankment No Arterial Street (Figure IV-34 thru IV-40)

The horizontal alignment between Camden Street and Ruggles Street would follow the existing Penn Central alignment which is on a tangent. At present the tracks are on an embankment section beginning at existing grade in the vicinity of Gainsborough Street and ascending at a 0.36 percent grade through Ruggles Street. The existing embankment neither has sufficient width for the proposed five tracks, nor does it provide adequate height to allow for adequate vertical clearance over the local street. Therefore the width of the existing embankment would be increased and the height of embankment raised

The profile of the embankment section between Camden Street and Ruggles Street would be constructed on a grade of 1 percent. It would raise the elevation of the embankment approximately 2 feet within this section and the embankment would be in a retained fill section from Camden Street to Ruggles Street (Fig. IV-39 and IV-40). The railroad bridge over Ruggles Street would be replaced under this alternative. The proposed Ruggles Street Station would be located north of and adjacent to Ruggles Street.

South of Ruggles Street, the profile grade would be 1.0 percent followed by a 0.6 percent and a 0.0 percent grade. This will maintain the required vertical clearances at Prentiss, Station and Tremont Streets. At these locations new railroad bridges would be constructed. The elevations of the embankment would be raised in this area by approximately four feet. The proposed

Roxbury Crossing Station would be located at Tremont Street. In this area, the rail/transit would be on a 1° (R=5730') horizontal curve to the left which extends from Tremont Street to New Heath Street (see Fig. IV-38 and IV-39).

The embankment section would continue south at relatively flat grades of 0.0, 0.7 and 0.5 percent which would add about one foot to the existing embankment. The horizontal alignment would transition from the 1° (R=5730') horizontal curve to a 600-foot-long tangent section. A 4000' R curve extends from Heath Street through Jackson Square to Roy Street. New bridges would be built over New Heath, Heath and Centre Streets. The proposed Jackson Square Station would be built between Heath and Centre Streets.

South of Jackson Square the horizontal alignment continues on a 1.4° (R=4000') curve to the right to the vicinity of Roy Street where a tangent section begins and extends to Hoffman Street. The alignment then curves left on a 1.4° (R=4000') to Paul Gore Street. A 1900-foot tangent section extends from Paul Gore Street to Cornwall Street followed by a 1°(R=5730') curve to the right to a point approximately 500 feet south of Williams Street. From that point the tracks follow a tangent alignment to a point 1500 feet north of Forest Hills where a short 5730' R curve to the left directs the tracks on a tangent alignment into the Forest Hills Station area. The vertical alignment in this section is made up of relatively flat grades (0.5 percent). The embankment would be raised an average of one to two feet (see Fig. IV-34 thru IV-37).

Replacement rail/transit structures would be built at Mozart, Boylston, Green, Williams, McBride and Morton Streets. A new rail/transit structure would be introduced at Minton Street where a pedestrian underpass presently exists.

The proposed stations in this section would be Boylston Street Station (Boylston Street), Green Street Station (Green Street) and Forest Hills Station located south of Morton Street.

Construction on local streets under this alternative would be limited to the areas around the proposed stations and any work necessitated by the replacement of rail/transit bridges over local streets.

4.4.7 Alternative FH-4, Rail/Transit on Modified Embankment, Arterial Street Crossing East to West (Fig. IV-41 thru IV-47)

West of the Massachusetts Avenue Station the horizontal alignment is on tangent to the vicinity of Ruggles Street (see Fig. IV-47). At present the tracks are on an embankment section beginning at existing grade near Gainsborough Street. They ascend at 0.36 percent grade through Ruggles Street, but the existing embankment neither provides sufficient width for the proposed five tracks, nor does it provide adequate height to allow for proper vertical clearance over the local streets. Therefore, the width of the existing embankment would be increased and the height of embankment raised. The profile of the embankment section between the Massachusetts Avenue Station and the Ruggles Street Station would be constructed on a grade of 1.0 percent. It would raise the elevation of the embankment an average of two feet within this section and the embankment would be in a retained fill section from Camden Street to Ruggles Street. The railroad bridge over Ruggles Street would be replaced and the proposed Ruggles Street Station would be located north of and adjacent to Ruggles Street.

The profile grade would be relatively flat south of Ruggles Street, maintaining the required vertical clearance at Prentiss, Station and Tremont Streets. At these locations, new railroad bridges would be constructed. The embankment would be raised approximately four feet above the elevation of the present embankment. The proposed Roxbury Crossing Station would be located at Tremont Street. In this area, the rail/transit is on a 4000-foot radius horizontal curve (see Fig. IV-45 and IV-46).

The embankment section (approximately three feet above the existing one) is continued south at a grade of 0.7 percent. The horizontal alignment transitions from the 4000-foot-radius horizontal curve to a 800-foot-long tangent section followed by a 4000' R curve through Jackson Square. New bridges will be built between Heath Street and Centre Street.

An arterial street follows the route of the proposed but now abandoned I-95 from Ruggles Street along the easterly side of the Penn Central tracks to Jackson Square. It continues to Boylston Street where there is an option either to remain on the easterly side of the tracks or to corss to the westerly side and to terminate at Forest Hills.

The route is similar to that defined in Alternative FH-2.

The arterial street being proposed for Segment two is a six-lane arterial beginning at Ruggles Street, located parallel to and east of the Penn Central alignment (see Fig. IV-45 thru 47). The arterial street would closely follow the Penn Central alignment which in this area is almost totally on a 4000-foot radius curve.

The roadway cross section for Segment two could consist of the following elements: sidewalks, planting strips, parking lanes, six travel lanes, and a raised median. Variations in the median width would occur at the following intersections for the purpose of accomodating left-turn storage lanes: Ruggles Street, Tremont Street, Health Street and Centre Street. Variations in the sidewalk and planting strip would also occur as part of green-space and land-development considerations.

A pedestrian drop area or kiss-and-ride slot would be provided for on the arterial at Roxbury Crossing Station.

The major intersections at Tremont, Ruggles, New Heath, Heath and Centre Streets would be signalized.

Segment two of the proposed arterial street can be designed and constructed to function properly without Segment three (see Figure IV-45A).

South of Jackson Square the horizontal alignment of the rail/transit facility continues on a 1.4° (R=4000') curve to the right to the vicinity of Roy Street where a tagent section begins and extends to Hoffman Street. The alignment then curves left on a 1.4° (R=4000) to Paul Gore Street. A 900-foot tangent section extends from Paul Gore Street followed by a 5730' R curve to the left and a tangent extending to Cronwall Street followed by a 1° (R=5730') curve to the right to a point approximately 500 feet south of Williams Street. From that point to Forest Hills the tracks follow a tangent alignment (see Fig.IV-41, IV-44). The profile of the rail/transit facility in this area is made up of relatively flat grades which would raise the elevation an average of three feet.

Replacement rail/transit structures will be built at Mozart, Boylston, Green, Williams, McBride and Morton Streets. A new rail/transit structure will be introduced at Minton Street where there is a pedestrian underpass and potentially at Mozart Street where the arterial street would pass under the railroad.

The arterial street option developed for Alternative 4 for the section between Jackson Square and Forest Hills has been designated Segment three. This option is dependent upon the construction of Segment two although this segment can stand alone as a viable option.

Beginning at Jackson Square, which is the southern limit of Segment two, the arterial would change if constructed from a six-lane divided roadway to a four-lane undivided roadway. The arterial road is aligned parallel and adjacent to the tracks on the eastern side to Mozart Street. Here, the arterial crosses under the Penn Central tracks. The arterial street is then aligned essentially parallel, and west of the track from Boylston Street to Forest Hills. At Forest Hills the arterial street crosses under the rail/transit facility and intersects Morton Street at Hyde Park Avenue. A traffic system has been developed at Forest Hills to allow for the free movement of traffic between Hyde Park Avenue, Washington Street, Morton Street and the proposed arterial street.

Under this alternative the streets which would underpass the railroad are Mozart, Boylston, Minton, Green, Williams and Morton. Changes in the existing street pattern within the Corridor include the relocation of Albert Street. Lamartine Street would be closed at Paul Gore Street south of Boylston Street. This would eliminate any through movement on Lamartine Street between Paul Gore Street and Hubbard Street. A short access road would be constructed between Lawndale Terrace and Lamartine Place parallel to the arterial street. A cross street would be constructed from Amory Street opposite Minton Street, under the tracks to the arterial road. Oakdale Road would be dead-ended midway between Cerina Road and Green Street. McBride Street would have an improved connection with Call Street on the west side of the tracks.

<u>4.4.8 Alternative FH-5, Camden Street to Forest Hills - Modified Depressed Rail/Transit, Arterial Street East</u> (Figs. IV-49 through IV-55)

In this alternative, the proposed track grade would be depressed to approximately a level above the existing ground water. The present railroad embankment, as in Alternatives FH-1 and FH-2, would be removed from Gainsborough Street in Back Bay to Forest Hills.

Horizontal alignment of the rail/transit facility would be as follows:

Chickering (Camden Street) to Tremont Street	Tangent
Tremont St. to north of New Heath Street	R=4500' ($D=1^\circ\ 15' \pm$)
North of New Heath St. to relocated Heath Street	Tangent
Relocated Heath St. to Roys Street	R=4500' ($D=1^\circ\ 15' \pm$)
Roys Street to Hoffman Street	Tangent
Hoffman Street to Mozart Street	R=6000' ($D=1^\circ \pm$)
From Mozart Street to South of Boylston Street	R=6000' ($D=1^\circ \pm$)
From south of Boylston Street to Cornwall Street	Tangent
From Cornwall Street to Gordon Road	R=6000' ($D=1^\circ \pm$)
From Gordon Road to Relocated Washington Street	Tangent
From Relocated Washington Street to End of Project (Delmore Road Vicinity)	R=6000' ($D=1^\circ \pm$)

Horizontal curvature for the tracks would have a minimum of R=4500 feet and a maximum of R = 6000 feet.

Passenger stations for the Orange Line would be located at the following street locations: Ruggles, Tremont (Roxbury Crossing), Centre (Jackson Square), Boylston, Green and Forest Hills. The station at Forest Hills would be the terminal point for the relocated Orange Line as well as for the Green Line and would have transfer facilities to the commuter rail. The station at Ruggles Street would also provide for connections to commuter rail service.

Continuing from the South Cove Alternatives (SC-1 and SC-2), the railroad grade would extend on level grade through the proposed passenger platform at Ruggles Street. Then it would ascend on a 0.5 percent grade, pass the Orange

Line station at Roxbury Crossing, and continue to Cedar Street. From Cedar Street, it would then level off to zero percent to New Heath Street. After climbing at 0.5 percent from New Heath Street to Jackson Square, the track grade would return to level between Center Street and Mozart Street.

The depressed railroad tracks would descend at 0.25 percent from Mozart Street pass the Boylston Street station to Lorene Place. From there, the track grade would climb at 0.3 percent, through the Green Street station, to the vicinity of Williams Street. It would then level off at 0.0 percent and continue to Forest Hills station. Once past the Forest Hills station, the tracks would then ascend at 0.7 percent until they climb out of the depression and merge with the existing 4 tracks in the vicinity of Delmore Road in Hyde Park.

The two Needham Branch tracks, once separated from the mainline, would ascend at 1.5 percent grade until they meet the existing tracks on the present embankment, approximately 2,000 feet from the Washington Street portal.

The Orange Line grade, as in previous segments, would be generally parallel and approximately three feet higher than the railroad for the entire length.

The Orange Line would climb up at 4 percent grade, under the relocated Washington Street, to a yard to the west of the Needham Branch tracks and at approximately the same level as the Green-Line yard. Four storage tracks would be provided for the Orange Line.

It was initially proposed that the Green-Line tracks would cross over the proposed relocated Washington Street, at grade with storage track in the present city parking area south of Asticou Road.

In response to City of Boston Conservation Commission testimony at the Public Hearing regarding the possible impact of the proposed trolley storage yards at Forest Hills on adjacent undeveloped land, the Authority has removed this item from the current Capital Grant Application. Additional consideration will be given by Authority Operations, Planning and Construction personnel to several options for both maintenance and storage of Green Line trolleys, with concern for conversion to an LRV fleet. This location, as well as others, will be considered.

MBTA Southwest Corridor Capital Grant Application has been revised to include a rail connection from the proposed Green Line station and layover area within the Forest Hills station complex to the existing trolley maintenance and storage facility in the Arborway yard. This revision will permit improved service on the Arborway Green Line while allowing a future modernization of the storage and maintenance facility (should maintenance facilities not be relocated to a new location).

Regrading of the existing embankment south of Forest Hills will be carefully engineered to preserve the current buffering effect of this earth mound in separating traffic on Washington Street to the east from the undeveloped land immediately to the west. Volume of runoff from this facility will be no greater than that produced today, so that no effect upon the hydrology of the undeveloped land is anticipated.

Once out of the restricted right-of-way in the Back Bay area, the tracks would return to the normal spacings from Chickering to Forest Hills. Tracks would be spaced 13 feet on centers for the Relocated Orange Line and 14 feet on centers for the railroad, with a minimum of 17 feet between the lines. The vertical clearance of 19 feet and 7 inches would be maintained under all structures crossing the depressed railroad. A low wall or slope, would separate the Orange Line from the railroad in the depressed section.

An arterial street similar to the one in Alternative FH-2 would also be provided in this alternative. Generally paralleling the new tracks, this arterial would be a new street beginning at Ruggles Street ending at Forest Hills. The arterial street would remain on the east side of the tracks and would have the same design features as described in Alternative FH-2.

Because of the grade of the new tracks (at or above the ground water level) and their proximity to the arterial, the arterial would be set approximately 24 feet above the tracks at the crossings in order to have a 19' - 7" clearance. Local streets such as Ruggles, Tremont, Cedar, Heath, Centre, Mozart, Boylston, Green, Gordon, Williams, McBride and Morton would be raised to meet the new grades.

Prentiss, Station, and New Heath Streets would be terminated at the new railroad right-of-way. Provisions would be made for emergency vehicles to cross over the proposed deck at Prentiss Street. Lamartine Street would be relocated with its section between Roys and Hoffman closed. Oakdale Street would be terminated north of Green Street. Call Street between Williams and McBride would also be realigned.

New bridges to carry local streets over the depressed tracks would be constructed. In some areas, pedestrian overpasses would be useful to local residents. In this Alternative, the following bridges and overpasses could be constructed:

Ruggles Street
Prentiss Street (pedestrian)
Tremont Street
Cedar Street
Heath Street
Centre Street
Mozart Street
New Heath Street (pedestrian)
Paul Gore Street
Boylston Street
Lorene Place
Cornwall Street (pedestrian)
Green Street
Gordon Street
Williams Street
McBridge Street
Morton Street
Washington Street

The new spans would be shallow and would have an intermediate support between the railroad and the Orange Line. The abutments would be flush with the retaining walls. The girders for these spans would be of structural steel, prestressed, precast concrete with reinforced concrete decks and asphalt concrete pavement.

Decks over the depressed railroad, which would act as sound barriers and which could be designed for recreational and other uses for local communities, would be constructed at these locations:

From Ruggles Street to Prentiss Street
From Heath Street to Centre Street
Mozart Street
Boylston Street
Green Street
Forest Hills

The existing Orange Line car shop south of the present Forest Hills station would be demolished at the appropriate time with all operations transferred to the Wellington car shop. The alternative includes the demolition of the present Orange Line overhead structure on Washington Street for its entire length.

Approximately 14 existing bridges and sections of retaining walls along the present railroad embankment would be demolished in the Alternative. These structures are constructed of granite block and structural steel girders which could be reused or salvaged as much as possible, for the construction of new walls, new bridges, and station facades.

4.4.9 Alternative FH-6, Camden Street to Forest Hills - Modified Depressed Rail/Transit, No Arterial South of Jackson Square (Figs. IV-56 through IV-60)

The rail/transit facility in this Alternative is identical to the one proposed in Alternative FH-5. The difference between the two alternatives is the extent of the arterial street construction. Alternative 6 does not construct the arterial street south of Jackson Square but terminates it there. Alternative 6a represents a slight modification in that it allows connections to Columbus Avenue.

As stated previously, the arterial street proposed from Massachusetts Avenue to Forest Hills could be constructed in segments. Segment two (from Ruggles Street to Jackson Square) could be constructed to function properly without Segment three (from Jackson Square to Forest Hills).

In this Alternative, the Arterial between Ruggles Street and Jackson Square (Segment two) would be included. Between Jackson Square and Forest Hills, local streets such as Mozart, Paul Gore, Boylston, Lamartine, Lorene, Cornwall, Green, Gordon, Amory, Williams, McBride, Call, Morton and Washington would be modified in order to be compatible with the new depressed rail/transit facility, but would not connect to a new arterial.

4.4.10 Alternative PHP-1, South Cove to Camden Street to Forest Hills - Post Hearing Profile for Depressed Rail/Transist, no Arterial Street South of Jackson Square (Figs. IV-54 through IV-60, IV-63, IV-64 and IV-65.)

The rail/transit facility in this Alternative is similar in profile and alignment to that in Alternative SC-1 between South Cove and Camden Street. From Camden Street to Forest Hills the plan of this alternative is similar to Alternative FH-6, with the exception of one street bridge which is added at New Heath Street in Roxbury. The Segment #2 Arterial must be built if this alternative is selected since the street elevation must be raised to allow appropriate clearances above the rail/transit facility.

Rail Facilities - South Cove Portal (Berkeley Street) to Chickering (Camden Street)

Reconstruction of all rail facilities (including the B&A) in the present railroad right-of-way would begin at a point east of Berkeley Street, where the previously approved South Cove tunnel project ends, and proceed to Chickering. This is a distance of about 1.1 miles.

The Orange Line rapid-transit tracks, which emerge from the South Cove tunnel, would be extended along with new railroad* tracks in the existing right-of-way. The railroad right-of-way would be widened in the Back Bay station area to allow for the new tracks and platforms. From Back Bay station south to Chickering, the two Orange Line tracks would be accommodated, together with three new railroad tracks, in the existing 66 foot right of-way which would be widened by approximately four feet to the east by construction of retaining walls.

The Orange Line tracks would be in a depressed right-of-way between Arlington and Camden Streets approximately two to three feet higher than the railroad.

The four existing railroad tracks would be replaced by three new tracks from Shawmut Avenue to Chickering. The tracks would be realigned

* The term "railroad" refers to FRA/AMTRAK as well as all MBTA commuter rail services throughout the text.

in order to clear the transition section from tunnel to surface of the Orange Line and the proposed Back Bay Station platforms. The new railroad tracks would be lower (approximately two feet at Back Bay and seven feet at Mass. Avenue) than the existing grade in order to attain 17'-8" vertical clearance required for railroad catenary operation, to remain generally just above ground water level, and allow the decks to remain below the sill of first floor apartment windows. Exact determination of track profile will be made in the first phase of the design engineering work.

The two existing B&A tracks would also be adjusted slightly (from approximately Arlington Street to Dartmouth Street), again to allow for the new platforms and tracks under the proposed Back Bay station.

The new platforms at Back Bay station would consist of the following elements:

1. A single center high platform 420 feet in length to accommodate six 65-foot MBTA Orange Line cars.

2. Two high platforms (one center, one side) for FRA/AMTRACK Northeast Corridor high speed rail and commuter rail, 1200 feet in length to accommodate fourteen 85-foot cars.

3. New track alignments would allow existing low platforms to be maintained for B&A operations and for conversion to high platforms in the future.

Major components of construction in this section would include:

- Complete reconstruction of the railroad bed, except that serving the B&A

- New drainage system

- New retaining walls on both sides of the expanded railroad right-of-way

- New ties, ballast, and welded steel rails

- New signal systems (railroad and Orange Line)

- New power system for Orange Line (AMTRAK/commuter rail electrification is not included in this project)

- Inclusion of materials and/or designs to minimize rail noise and vibration

- Sound attenuating devices (decks, walls, platform canopies, landscaping, etc.) to reduce noise impact on adjacent residents.

- Creation of open spaces with landscaping, walls and fences appropriate to the historic district in areas of structure demolition

- Construction of a new Back Bay Station to provide accessibility for the handicapped and provide intermodal transfers between AMTRAK, commuter rails, rapid transit (Orange Line), bus taxi, automobile, and pedestrians

- Orange Line Station at Massachusetts Avenue between Columbus Avenue and St. Botolph Street

- Reconstruction of bridges carrying local streets over the tracks at the following locations:

Berkeley Street	Dartmouth Street
Columbus Avenue	West Newton Street
Clarendon Street	Massachusetts Avenue

Camden Street, Braddock Park, West Rutland Square (pedestrian overpasses)

- Reconstruction and landscaping of Carleton and Claremont Streets adjacent to the rail right-of-way and ends of streets dead-ending at the right-of-way off St. Botolph Street.

Rail Facilities - Chickering to Forest Hills

Between Camden Street and Forest Hills it is proposed to depress the rails 10-25 feet below the adjacent lands in this area and to eliminate the existing railroad embankment. The alignment would be modified to: (1) allow for the construction of the two Orange Line tracks west of and parallel with the three AMTRAK/commuter rail tracks; (2) attain minimum curves of 1 - 15' for the railroad; and (3) meet the new vertical clearance of 19'-7" for the railroad.

The construction of the railroad bed in a depressed section is to follow a profile determined by a Task Force on Vertical Profile established by the MBTA as the result of comments at the project's Public Hearing. This profile was established subsequent to the Public Hearing, and makes adjustments to the Modified Depressed Facility in response to comments made at that hearing. The track profile proposed would vary with respect to the water table; at some points it would be above ground water, and at other locations within ground water and protected by boat section construction. This new profile meets the criteria of those speaking at the Public Hearing in that it provides the effects of the fully depressed alternative. This is achieved at certain locations by raising of adjacent streets and ground levels. The Orange Line would generally be approximately four feet higher than the railroad to avoid excess excavation. Bridges would be double span structures supported on columns between railroad and transit tracks, thus allowing a shallower section spanning the railroad/transit facility in order to minimize the elevation of the street crossings.

Six stations with full access for the handicapped are proposed in all Alternatives at Ruggles Street, Roxbury Crossing, Jackson Square, Boylston Street, Green Street, and Forest Hills.

Major components of construction in this Alternative would include.

- Removal of the existing railroad embankment and railroad bridges
- Construction of the roadbed in a cut section with retaining walls and in boat section as required by relationship to ground water level
- New drainage systems
- New ballast, ties and welded steel rail
- New signal systems (railroad and Orange Line)
- New power system for Orange Line (power system for railroad not included)

- Inclusion of materials and/or designs to minimize rail noise and vibration

- Sound attenuating devices, similar to those previously stated

- Major rapid transit/commuter rail stations at Ruggles Street and Forest Hills with intermodal transfer facilities.

- Jackson Square Station with intermodal transfers between rapid transit, bus, automobile and pedestrian

- Additional rapid transit (Orange Line) stations at Roxbury Crossing, Boylston Street and Green Street

- New bridges at the following locations:

Ruggles Street	Boylston Street
Prentiss Street	Minton St/Lorene Rd
Tremont Street	Green Street=
Cedar Street	Gordon Street
New Heath Street	Williams Street
Heath Street	McBride Street
Centre Street	Morton Street
Atherton/Mozart Streets	Washington Street

- Construction of bicycle and pedestrian access to the transit stations and a continuation of the Green Belt between the Fens and Columbus Avenue. The Green Belt which is part of this project connects from Ruggles Street to the Arborway, consisting of bike paths, landscaping, lighting and trails

- Decks for sound attenuation and community connectivity at the following locations:

  Mission Hill between Ruggles Street and Prentiss Street
  Bromley Heath between Heath Street and Centre Street
  Jamaica Plain between Minton St/Lorene Rd bridge and Cornwall/Oakdale Streets
  Jamaica Plain between Williams Street and McBride Street

Arterial Street Facilities

The arterial street is not a part of the MBTA Capital Grant Application. However, as a part of the Southwest Corridor Project, it interfaces with the rail/transit facilities to form the transportation system of the Project.

Arterial Street construction is possible paralleling the Penn Central right-of-way from the intersection of the new proposed crosstown street to Forest Hills. It is described in two segments as follows:

Segment Two - Tremont Street/Columbus Avenue to Jackson Square

The Segment Two arterial would be a street with three lanes signalized at-grade in each direction separated by a raised median. Major intersections with left-turn lanes would be provided at Ruggles, Tremont, Cedar New Heath and Centre Streets. Sidewalks and landscaping to improve visual impact as well as bikepaths and lighting as part of a Green-belt open space would also be provided. The alignment of the arterial generally parallels that of the proposed tracks.

Segment Three - Jackson Square to Forest Hills

In PHP-1 there is no arterial south of Jackson Square.

4.4.11 Alternative PHP-2, South Cove to Camden Street to Forest Hills - Post Hearing Profile for Depressed Rail/Transit, Arterial Street East (Figs. IV-49 through IV-55, IV-63, IV-64 and IV-65.)

This Alternative is identical to PHP-1, except that an arterial street would be constructed south of Jackson Square.

The arterial, if constructed south of Jackson Square, would be located parallel to and east of the railroad and would provide a route that offers continuity between Forest Hills and Jackson Square. This arterial segment, if built, would be constructed as a four-lane undivided street. Major signalized at-grade intersections would be provided at Mozart, Boylston, Green, Williams, McBride, Morton, and Washington Streets. Modifications would be made on the local street approaches to the arterial. Retaining walls and fill slopes would be necessary at certain locations. A decision regarding the construction of this segment of street is pending and would be made after E.I.S. completion. If either segment were not constructed, local street revisions and bridges across the rail-right-of-way would still be constructed as a part of this transit project.

4.4.12 Passenger Stations

The design of each of the proposed eight stations in the Southwest Corridor Project will take into account local neighborhood patterns of land use and pedestrian access, reuse of adjacent vacant parcels, and other urban design considerations.

The character of the South End and Back Bay Historic Districts will be respected in the design of both the Back Bay and Mass. Avenue Stations (neither station is actually within either historic district, but is adjacent to one or both districts). The MBTA will invite the Massachusetts Historical Commission to nominate representatives from both Historic Districts to review all proposals for services received from consultants for engineering and architectural design so that they might offer advice to the MBTA on the choice of consultants. Station design will be reviewed with local residents and the Historical Commission nominees prior to completion of construction documents.

The design of the proposed new facilities will be made with consideration of problems of security. Stations will be designed to expose platform and entry levels to the view of the station attendant and patrons of the system. Column free designs which eliminate unseen areas will be employed where possible. Line-of-sight exposure of all areas will be considered, with clear distinctions made between public access ways and private use zones. The new facilities will not duplicate the long vertical climbs and hidden mezzanines and passages prevalent in the existing Elevated facility.

All stations will be designed for barrier-free access for the handicapped. Major transfer points between bus and rapid transit are planned at Forest Hills, Jackson Square and Ruggles Street. Each of these stations will require space for boarding, drop-off and some provisions for layover. None is expected to be a bus storage or maintenance facility. These are also the most important stations from the standpoint of joint development and the creation of commercial centers to replace those destroyed by the demolition for the highway right-of-way.

It is anticipated that the design phase will further develop the specifications for bus facility requirements as well as the exact scope of joint and private development in the station area. Some modification of the layouts illustrated will be made at that time. Of particular importance will be the relationship of bus movements to pedestrian circulation both within and outside the station, and of the relationship of bus movements to vehicular traffic.

Design of indicator signs in new stations for the Relocated Orange Line and Commuter Rail system in the Southwest Corridor Project will be in Spanish as well as in English.

4.4.12.1 Back Bay Station (see Figs. IV-70 and IV-71)

The Back Bay Station is planned to serve as a major transportation gateway to the City of Boston. It would provide a principal in-town modal change facility serving the Back Bay, South End, and St. Botolph districts. It would accommodate convenient and efficient passage between intercity and commuter rail as well as transit, local bus, taxi and automobile drop-off.

Located in an area with both major existing commercial facilities and the potential for extensive future development, the proposed Back Bay Station would have a scale and commodity (approx. 42,000 sq. ft.) appropriate to its anticipated high level of use. It would be constructed at the site of the existing Back Bay Station. The station is located at the border between the major retail, office, and institutional facilities of the Back Bay, and, the chiefly residential districts of St. Botolph Street and the South End. Further, it is located in the border area between the National Historic Districts of the Back Bay and South End. As such, the Station's architectural character should respond to the unique scale, detail, and distinctive qualities of the site.

The proposed Station would assume an atrium form with a skylit central space rising two stories to the roof. This central space or atrium (12,000 sq. ft.) is the principal waiting and staging area from which access to the various transit and railroad lobbies and platforms (Orange Line Transit, AMTRAK, commuter rail, B&A) is provided. As the point of entry to Boston for many travelers and commuters, it should provide a particularly pleasing and well-appointed experience.

In regard to the configuration of the station, at street elevation, there is no significant difference between the transit and rail-at-grade alternative and the transit-in-tunnel alternative. The specific configuration of the transit lobby, and access to corresponding platforms would vary slightly in response to the platform location in each instance. The lobbies and platform access points for the Orange Line Transit, Commuter Rail, AMTRAK, B&A, would be positioned on the perimeter of the atrium. A number of station-entrance points, operational, informational, and concession services would also be positioned there.

In the proposed station, there are three primary points of entrance to the lobby. The main pedestrian entrance to the station would be located on Dartmouth Street with direct access to the transit lobby. Waiting vehicles would be accommodated by a vehicle zone for drop-off and short-term parking. Direct access to the station from this vehicle zone is provided by a pedestrian plaza appropriate for the transfer of passengers and their baggage between the station and waiting vehicles. An existing pedestrian bridge from the John Hancock parking garage has been provided with direct access to permit convenient use of its long-term automobile storage.

In both of the proposed station alternatives, vertical circulation would provide access to the platforms by means of escalators and stairs. Elevators would be provided for the handicapped. In both station alternatives all platforms are high. This permits direct access to all trains without a level change. (All changes must be made at lobby level, no cross-platform transfer is possible.)

In the transit-and-rail-at-grade alternative, the Orange Line would have one end-loaded island platform, 410-feet long and varying in width from 23 to 18 feet. The two AMTRAK and commuter-rail platforms would be end loaded and work side by side as center and side-platforms, 1200-feet

long, serving three tracks. A BA center-loaded island platform could be provided in the future. In the same alternative, the vertical circulation provides direct access to all platforms one level below.

In the second alternative (transit in tunnel) the Orange Line would have two end-loaded side platforms, 410-feet long varying in width, from 35 to 25 feet. The two AMTRAK and commuter-rail platforms, again, would be end loaded and work side by side as center and side platforms 1200-feet long, serving three tracks. A B&A center-loaded island platform could be provided in the future. In the same alternative, the circulation passes through two lower levels. At the first, the AMTRAK and commuter-rail platform level, it provides direct access to those platforms. Further, at this level it provides controlled access between the AMTRAK and commuter-rail platforms and the transit platforms by means of unattended turnstiles. At the transit-platform level, it provides direct access to the transit platforms. In both alternatives, the transit and rail platforms are provided with an unsupervised exit only to permit direct exit from the platform below the intersection of Clarendon Street and Columbus Avenue.

The local street pattern in the vicinity of the station should be modified slightly to permit clear and efficient vehicle access to the station. Specifically, the intersection of Buckingham Street, Columbus Avenue and Clarendon Street would be modified by relocating the Buckingham Street leg of that intersection to the edge of the John Hancock Garage at Clarendon Street. This clarifies the intersection of Clarendon and Columbus, making it a standard four-legged intersection, and permits the introduction of an exit plaza providing access to the transit and rail platforms below. Further, Buckingham Street would provide access to an auto drop-off lane and taxi lane in a vehicle zone permitting adequate holdover space adjacent to the pedestrian plaza.

The proposed station would be constructed of cast-in-place, reinforced concerete columns and coffered slab. The feasibility of columns, footings and slab seats capable of supporting appropriate air-rights decks in a clear and efficient manner should be investigated. Appropriate durable, vandal-resistent materials and finishes such as brick, concrete, ceramic tile, steel and glass should be used throughout. Architectural elements such as skylights and clear-stories as well as materials such as glass block should be used wherever feasible to introduce natural light and ventilation.

The design of the station has responded to the potential for related joint development. With the necessary structural capabilities, the station could combine air-rights development such as office space, either in conunction with the initial construction or coordinated at some future point in time. Further, the entrances to the station have been positioned so as not to preclude the development potential of adjacent sites. Related concession and commercial space would be incorporated, to introduce vitality in the station lobby.

4.4.12.2 Massachusetts Avenue Station: (See Fig. IV-74)

The Massachusetts Avenue Station would be an Orange Line transit station providing some local bus access and no commuter rail or AMTRAK service. It would provide service to the South End, St. Botolph Street area and Fenway districts and it would be used heavily by pedestrians.

The station site would be in an underutilized parking lot to the rear of the Boston Arena and fronting onto Massachusetts Avenue. It is in an area of mixed commercial and residential structures with some prominent rehabilitation, as well as cleared and vacant parcels. The area is adjacent to the institutional resources of Northeastern University, the New England Conservatory, the Berkeley School, and the Christian

Science Center as well as Symphony Hall and Horticultural Hall. Further, it is adjacent to Carter Playground and the proposed City of Boston Middle School.

The Regional Trail would meet Carter Playground, and be provided with access to the station by a reconstructed pedestrian bridge at Gainsborough Street and rampt to the station lobby and Massachusetts Avenue. The possibility of easements to provide a direct open space accessway from Carter Playground to Claremont Street should be examined in coordination with more detailed aspects of the project.

The station would provide an at-grade lobby in a single pavilion. It would permit pedestrian access to Massachusetts Avenue and bus berths would permit the transfer of passengers without impeding the flow of traffic.

There is little significant difference in the functional plan of the alternatives. Principally the alternative in which the tracks are at existing grade, the station would be at grade with a pedestrian-activated signal crossing to permit safe access from the in-town side of Massachusetts Avenue. In the alternative suggesting depressed tracks, the station would be slightly below grade in the same location, with a pedestrian tunnel to provide grade-separated pedestrian access to the in-town side of Massachusetts Avenue.

Access to all platforms would be provided with an adequate number of stairs and ramps appropriate for the handicapped. The transit platform would be an island platform, 410-feet long and 30-feet wide, with an unattended exit to permit access to a pedestrian bridge at Gainsborough Street.

There would be no significant change in the local-street network. The proposed station and all other stations in the proposed project and its alternatives (Back Bay Station is an exception) would have the same construction. Construction would be cast-in-place, reinforced columns and coffered slab with floor or deck areas of high regularity and integral beams seating precast T sections. Durable, vandal-resistant material such as brick, concrete, steel, and ceramic tile should be used throughout. Architectural elements such as skylights and clearstories, as well as materials such as glass block should be used wherever feasible to bring in natural light and ventilation.

The design of the station responds to the potential for related joint development. Its relationship between adjacent development parcels and to Massachusetts Avenue, which is the primary shopping district, provides for maximum interface. Related commercial space could be incorporated into the station's design particularly that portion which would front Massachusetts Avenue.

The Boston Arena is a major resource to provide recreational and athletic facilities to the area. The station could provide for a future direct connection to the Arena. The station, would therefore, encourage the use of the Arena and would draw additional riders to the proposed transit facility.

4.4.12.3 Ruggles Street Station: (See Fig. IV-77)

The Ruggles Street Station would be a major modal-change facility serving both proposed and future transportation modes. It would accommodate the proposed Orange Line Transit and Commuter Rail Lines, and serve local buses, vehicles from local streets and the proposed arterial street. Particular emphasis has been placed on the facility as a major local bus terminus. Further it would accommodate a proposed

cross-town grade-separated transit link in the future. The station site is located within the Roxbury district of the corridor, an area subject to the most significant clearance. This area should be able to support extensive development in the future. In this capacity, the station has been designed to support the efficient transfer of a large number of anticipated passengers and vehicles, and to allow future joint development.

Station drawings for the proposed Ruggles Street Station indicate the connections to a circumferential or cross-town transit system with a platform at Ruggles Street. The provision of foundations and structural shell for a cross-town tunnel will be made in the engineering design of the station. A determination of the extent of this construction will be made based upon the consideration of joint development of parcel #18 adjacent to the facility. The station will be constructed in a manner that will permit joint development at the earliest possible date without later disruption.

The station site is cleared and used in part for surface parking. It is located adjacent to Northeastern University and is near the institutional resources of the Fenway district. It is adjacent to Mission Hill and Whittier Street Public Housing. The proposed Regional Trail would follow adjacent to the tracks from Forest Hills and meet the station at Ruggles Street. Similarly, Columbus Avenue would provide the South End with pedestrian access to the station at Ruggles Street. These factors indicate that the station site would be approached from these directions by a substantial number of pedestrians and that appropriate vehicle free zones should be provided.

The station configuration is essentially a pedestrian island, surrounded by the necessary vehicle loops and bus berths. A sufficient pedestrian plaza and cover would be provided to maintain clear movement and transfer in all weather conditions. The station area would be a major bus terminus with transfer and layover capabilities. Waiting vehicles would be accommodated on the perimeter of the pedestrian plaza. Buses would be provided with special berths for the transfer of passengers and the layover of appointed bus routes.

There is little significant difference in the functional station design of any of the alternatives (land use and environmental differences are described in 7.4). In the tracks-depressed alternatives, vertical circulation would provide access to the platforms below. In the tracks-elevated alternative, vertical circulation would provide access to the track and platform deck above. In the second alternative, the platform above it would serve as a canopy to the bus plaza.

The station lobby would consist of two pavilions joined by a breezeway (covered pass through). It would permit access to Ruggles Street at one end and to the bus plaza at the other. Skylights in its cover and along its edges would permit introduction of natural light to commuter-rail platforms below. As one enters from the bus plaza, access to the inbound commuter rail platform would be in the minor pavilion on the left. Access to the outbound commuter-rail and transit platform would be in the major pavilion on the right.

In the alternatives, the platform access and configuration for both transit and rail lines is essentially the same. In the major pavilion there would be two points of entrance, one at Ruggles Street and the other on the breezeway. In the minor pavilion there would be one entrance, also on the covered breezeway. The correspondent lobbies and platform-access points for the Orange Line transit and commuter-rail line would be located in either pavilion.

Access to all platforms would be provided with an adequate number of stairs and ramps appropriate for use by the handicapped. In the proposed system, all platforms would be high, permitting direct access to all trains without a level change. All changes would be made at lobby level. No cross platform transfer would be possible. The transit platform would be an end-loaded island platform, 410-feet long and 30-feet wide, with an unattended exit to permit access to a bus plaza above. The two commuter-rail platforms would be center-loaded side platforms, 1040-feet long and 20-feet wide. Further, in both alternatives there would be provisions in the design of the station for the necessary platforms and platform access for a future crosstown transit link.

The local-street pattern in the vicinity of the station should be modified in coordination with the arterial street plans. The proposed loop permits clear and efficient vehicle access to the station. Access to the loop is possible from local streets (Ruggles Street and Columbus Avenue) as well as from the proposed Arterial Street. In the tracks-depressed alternatives,both Ruggles Street and the loop would be constructed in coordination with the station deck. In the tracks-elevated alternative,the same roads would be constructed by a cut in the embankment with the track and platform deck above. In all alternatives, the proposed Regional Open Space Trail would pass through the station site to meet Carter Playground in the South End by means of Columbus Avenue.

The design of the station site responds to the potential for related, joint development with provisions for direct pedestrian station access. The station should be of a character that will tie the existing communities with the facilities of Northeastern University in an appropriate manner. Its related development should provide an identifiable gateway to Northeastern and an interface to local community development on the adjacent cleared land. To this end, column seats and footings would be provided where feasible for future construction.

This intersection of the various transportation modes (Orange Line) rapid transit commuter rail, local bus and arterial street) that intersect at this point indicates an anticipated high level of use. The relationship of the station, as well as its entrances and pedestrian plaza, to the surroundings provides the maximum interface with one of the most prominent adjacent development parcel in the Southwest Corridor.

<u>4.4.12. 4 Roxbury Crossing</u>: (See Figs. IV-79 and IV-88)

The Roxbury Crossing Station would act as a principal Orange Line transit station which would provide some local bus access and no commuter rail or AMTRAK service. It would provide service to Roxbury, and specifically, to Campus High School. Pedestrians would find it very convenient with appropriate pedestrian bridges to provide grade-separated crossings and access to the station.

The station site is in an area of extensive clearance. It is an area of mixed commercial and residential districts as well as prominent existing and proposed academic facilities. It is adjacent to Campus High School, currently being built, and the proposed Roxbury Community College site. The proposed Regional Open Space Trail would pass through the station site adjacent to the tracks.

The station, as planned, would provide an at-grade lobby in a single pavilion. It permits pedestrian access from Tremont Street. Bus berths permit buses to transfer passengers without impeding the flow of traffic. Related commercial space, such as a newstand, have been incorporated in its design.

There is little significant difference in the functional station design of the alternatives. Principally, in the tracks-depressed alternatives the vertical circulation provides access to the platforms below. In the tracks-elevated alternative the vertical circulation provides access to the track and platform deck above.

In both alternatives, a pedestrian bridge crossing over the Arterial Street (relocated Columbus Avenue) would provide safe access from the station to the site of Campus High School. Access to all platforms would be provided with an adequate number of stairs and ramps appropriate for use by the handicapped. The transit platform would be an end-loaded island platform, 410-feet long and 30-feet wide.

The local street pattern in the vicinity of the station would be modified in coordination with the Arterial Street plans. In the tracks-depressed and modified-depressed alternatives, Tremont Street would be constructed in coordination with the station deck. In the tracks-elevated alternative, it would be constructed by cutting through the embankment with a track and platform deck above. In both alternatives the proposed Regional Trail would pass through the station site, in coordination with street plans.

The design of the station takes into account the potential for related joint development. Its relationship to Tremont Street, the primary shopping street in the district, provides the maximum interface between both. Special efforts should be made to tie the existing neighborhood with proposed academic facilities in order to encourage community continuity.

<u>4.4.12.5 Jackson Square Station</u>: (See Figs. IV-81, IV-83 and IV-88)

The Jackson Square Station would be an Orange Line transit station providing some local bus access and no commuter rail or AMTRAK service. It would provide service to Roxbury and Jamaica Plain. It would be most useable to pedestrians. Necessary vehicle loops and bus berths, however, would be provided for the transfer of passengers and the holdover of appointed routes.

The station site is in an area of mixed commercial and residential districts with some manufacturing and industry. The site is adjacent to the Bromley-Heath public housing project. In the depressed alternative, a playground deck which would be built over the station, would shield the housing project from rail and transit noise (especially the upper stories). Further, it would provide extended facilities for the Albert Street Playground, which is insufficient for the level of use imposed by the high density of the housing in the area. The proposed Regional Trail would follow adjacent to the tracks and pass through the station area with access to the playground deck.

The station configuration is essentially a pedestrian island surrounded by necessary vehicle loops and bus berths. A pedestrian plaza and cover, furnished by the playground deck, would be provided to maintain clear movement and transfer in all weather conditions. The station would provide an at-grade lobby in two pavilions. The major pavilion would permit pedestrian access from Centre Street and the pedestrian plaza. Related commercial space would be incorporated in design. The minor pavilion would permit pedestrian access from Heath Street and the pedestrian plaza.

There is little significant difference in the functional station design of the alternatives. Principally, in the tracks-depressed alternatives the vertical circulation would provide access to the platforms below. In the tracks-elevated alternative, the vertical circulation would provide access to the track and transit platform above, but no playground or acoustic deck would be provided.

Access to the transit platform would be provided with an adequate number of stairs and ramps appropriate for use by the handicapped. It would be an island platform, 600-feet long and 30-feet wide, with access at each end.

The local street pattern in the vicinity of the station would be modified in coordination with the proposed arterial street plans. In the Arterial-Street-through-Jackson-Square alternative, it would follow through the station site adjacent to the tracks. In the Arterial-Street-to-Jackson-Square alternative, it would either pass through the station site adjacent to the tracks and stop at Centre Street and would connect directly to Columbus Avenue. In the Arterial-to-Forest Hills-Alternative, it would continue along the rail right-of-way. In the tracks-depressed alternatives, Centre and Heath Streets would be reconstructed in coordination with the station. In the track-elevated alternative, the same street would be reconstructed by cutting through the embankment with the track and platform above. In all alternatives the proposed Regional Trail passes through the station site and provides pedestrian access to it.

The design of the station responds to the potential for related joint development. The relationship of Centre Street (the primary shopping street in the district) to the major station lobby permits the maximum interface between both, with continuity of commercial space between the existing and proposed.

<u>4.4.12.6 Boylston Street Station</u> (see Fig. IV-85, IV-87 and IV-88)

The Boylston Street Station would be on Orange Line Transit station providing some local bus access and no commuter rail or AMTRAK service. It would provide service to Jamaica Plain and would be applicable for use by pedestrians, approximately 15 spaces for short-term parking for waiting autos, as well as bus berths for the transfer of passengers would be provided.

The station site is located in an area of small-scale mixed residential and commerical districts with occasional manufacturing and industrial districts on the east side of the tracks. Presently, there are substantial temporary recreational and open-space facilities located adjacent to the west side of tracks. The proposed Regional Trail would follow adjacent to the tracks and pass through the station area with access to those facilities when they become permanent. A sufficient pedestrian plaza would provide access to an at grade lobby. Related commercial space could be incorporated in the station.

There is little significant difference in the functional station design of the station alternatives. In the arterial east tracks-depressed alternatives, and the no-build arterial tracks-depressed alternative vertical circulation provides access to the platform below. In the tracks-elevated alternative No-build arterial alternative it provides access to the track and platform deck above.

Access to the transit platform would be provided with an adequate number of stairs, escalators, and ramps appropriate for use by the handicapped. It would be an end-loaded island platform, 410-feet long and 30-feet wide.

The local street pattern in the vicinity of the station should be modified in coordination with the proposed arterial street plans in the corresponding alternatives. In the arterial-east alternatives, it would follow adjacent to that side of the tracks and provide vehicle access to the station. In the arterial no-build alternatives, the local streets would not be altered except for necessary station access.

In the tracks-depressed alternative, Boylston Street and Paul Gore Street would be constructed in coordination with the station. In the tracks-elevated alternative, the same cross streets would be constructed by means of a cut in the embankment with the track and station platform above. In all alternatives the Regional Trail would pass through the station site.

The design of the station would encourage some small-scale commercial development to provide vitality to the station. The relationship of the station lobby to Lamartine Street which is the primary shopping area will permit the maximum interface.

4.4.12.7 Green Street Station (see Fig. IV-88, IV-90 and IV-92)

The Green Street Station would be an Orange Line transit station providing some local bus access and no commuter rail or Amtrak service. It would provide service to Jamaica Plain and would be very useful to pedestrians. It would provide approximately 15 spaces for short-term parking, parking for waiting autos, as well as bus berths for passenger transfers.

The station site is located in an area of small-scale mixed residential and commercial districts with occasional manufacturing and industrial districts adjacent to the tracks. One of such districts, the Boston Gas site, is currently under study for modification and use as Southwest II High School. The proposed high school and playfields would be located between McBride Street and Green Street abutting the east side of the tracks. Further, the proposed Regional Trail would follow adjacent to the tracks, and it would provide pedestrian access from the station to these facilities.

A pedestrian plaza would provide access to an at grade lobby. Related commercial space could be incorporated with the station in the future.

There is little significant difference in the functional station design of the station alternative. In the Arterial East track-depressed alternative, and the No-Build Arterial track-depressed alternative, vehicle circulation provides access to the transit platform below. In the tracks-elevated, No-Build alternative, it provides access to the track and transit station platform above.

Access to the transit platform would be provided with an adequate number of stairs, escalators, and ramps appropriate for use by the handicapped. It would be an end loaded island platform, 410-feet long.

The local street pattern in the vicinity of the station should be modified in coordination with the proposed Arterial Street plans in the corresponding alternatives. In the Arterial East alternatives it would follow adjacent to that side of the tracks and provide direct vehicle access to the station. In the Arterial No-Build alternatives, the local streets would not be modified beyond that necessary for the vehicle loop which provides access to the station.

In the tracks-depressed alternatives, Gordon Street and Green Street would be reconstructed in coordination with the station. In the tracks-elevated alternative, the same cross streets would be reconstructed in a cut through the embankment with the track and station platform above. In all alternatives the Regional Trail would pass through the Station Site.

The design of the station would encourage some small-scale commercial development to provide vitality to the station. The relationship of Green Street, the primary adjacent shopping street to the station should permit the maximum interface between both.

4.4.12.8 Forest Hills (see Fig. IV-95 and IV-96)

The Forest Hills Station would serve as a major transportation modal-change facility providing walk-in service to Jamaica Plain and northern Roslindale. It would replace the existing station and would provide convenient and efficient passage between commuter rail, Orange Line and Arborway Green Line transit, local bus, taxi and automobile service.

Particular emphasis has been placed on the facility as a major local bus terminus serving districts to the south and west. The station site is located in an area of mixed residential and commercial districts, and has many transportation facilities.

Arnold Arboretum, Forest Hills Cemetery, and Franklin Park are major regional open-space facilities in the vicinity of the station. Transportation facilities such as the existing Orange and Green transit lines as well as the Arborway, a major vehicle grade-separated overpass, criss-cross the station site. The Arborway Overpass links the Arboretun with Franklin Park for vehicle traffic. It replaced a former ground-level pedestrian connector.

The proposed Regional Trail would follow adjacent to the tracks meeting Forest Hills at the station lobby, providing to pedestrian and bicycle access.

The configuration of the complex is essentially a pedestrian island with a vehicle access on its perimeter. Ramps for automobile level changes are provided at the out-of-town southern end of the complex.

The Station is a complex of station platforms and lobby space, structured parking, bus berth, and related commercial development.

It would extend 1700 feet adjacent to both relocated Washington Street and Hyde Park Avenue at each end, a two way connector (relocated Morton and Walk Hill Streets) have been provided to permit traffic to flow around the complex in a continuous loop. It would be a major bus terminus with transfer and lay-over capabilities for various routes. Waiting vehicles would be accommodated on the perimeter of the pedestrian island. Buses would be provided with a special berth for the transfer of passengers, and the layover of appointed bus routes. The berths would be provided with sufficient cover to maintain a high level of service in all weather conditions.

There is little significant difference in the functional station design alternatives. Principally, in the tracks-depressed alternatives the vertical circulation provides access from the lobby and bus concourse

level to the platforms below. The same alternatives provide a parking deck for 500 cars on a single floor covering the complex. Related commercial development would be provided in the lobby at the Hyde Park Avenue level.

The proposed parking decks for both of the alternatives provide for the parking of a minimum number of cars. If the Orange Line is not extended and Forest Hills becomes the last station on the line, additional space could be provided later for an additional 1,000 vehicles. This could be accomplished with two decks which would cover the entire complex.

The station lobby is located on the in-town northern end of complex. In both alternatives access from the Washington Street side is at grade. In the tracks-depressed alternative access from the Hyde Park Avenue side is provided by a grade separated pedestrian bridge at one level above grade crossing Hyde Park Avenue. All platforms provide stairs and ramps for use by the handicapped. In the proposed system all platforms would be high, permitting direct access to all trains without a level change. All transfers would be made at lobby levels. No cross platform transfer would be possible. The transit platform would be an end-loaded center platform, 440-feet long and 30-feet wide. The two Commuter-Rail platforms would be end-loaded side platforms, 1040-feet long and 20-feet wide. The Green Line Station would consist of an off-street loop, layover tracks and storage facilities.

The local street pattern in the vicinity of the station would be modified in coordination with the pedestrian island and vehicle loop. Further, it would be modified to coordinate the arterial street if the street is built in the future. Access to the loop would be from local streets as well as the arterial, if built. In the tracks-depressed alternatives the two-way connectors at either end of the station complex would be constructed in coordination with the station deck. In the tracks-elevated alternatives, the same roads would be constructed by a cut in the embankment with the track and platform deck above.

The design of the station complex has incorporated related joint commercial development and is sympathetic to the potential for these developments on adjacent sites. The station and its corresponding commercial development should be of a character that will tie existing commercial development to the entire complex. The intersection of the various transportation modes (Orange Line and Green Line transit, Commuter Rail, local bus and possible Arterial Street) that intersect at this Point, indicates an anticipated high level of use. The station as designed would be appropriate to such use.

4.5 Other Alternatives Studied

A complete set of alternatives (as well as options within those alternatives) was analysed during the study process. As a result, of preliminary analysis and after community review, certain alternatives were carried to a level of detail necessary for reasoned choices. For these alternatives, impact analysis was generated only to that degree considered adequate for decision-making purposes. Other major alternatives studied include:

4.5.1 Improvements to Washington Street Elevated

Structural analysis conducted in 1973 revealed that the entire 4.3-mile length of the structure was in urgent need of repair and painting. The structure which is more than 70 years old received its last major painting in the early 1940's.

The nature of the repairs, begun in 1973 and currently underway, included reinforcing of structural components and connections, painting and general maintenance. In all, 2.6 million dollars was programmed for the structural rehabilitation completed in 1974. In addition, a 2.4 million dollar painting contract was funded and is currently underway with completion scheduled for December 1976. Station rehabilitation is also being undertaken at a cost of 1.5 million dollars. A track-realignment project, south of Dudley Station is being considered in order to provide better curvature needed to accommodate longer cars and to permit street improvements below. The realignment cost is set at $600,000.

The repairs already undertaken as well as others programmed for the near future should provide for the integrity of the structure for up to 10 years.

Measures which would reduce the noise and vibration levels of the elevated line, though possible to construct, have minimum influence on the environmental system. Noise attenuation devices attached to the lateral and underside of the structure, would cause reductions in noise levels along Washington Street (10-15dB), and virtually no reduction in noise levels above track grade. Structural complications, however, are inherent in this system due to the additional weight of the noise barriers, compounded by increased ability to attract snow and wind loadings. Additionally, the environmental price to pay for this reduction in noise is loss of sunlight. Sunlight is already a scarce commodity on Washington Street due to the elevated structure.

Noise and vibration can also be reduced (5-10 dB) through the use of continuously welded rail, resilient fasteners and a continued maintenance program of wheel truing and rail grinding. The installation of continuously welded rail and resilient fasteners, however, is not considered feasible while simultaneously maintaining Orange-Line operations uninterrupted. Additional stresses would also be introduced in the "EL" structure.

A comparison of the primary parameters for consideration of this alternative is shown below:

<u>Benefits</u>	<u>Disbenefits</u>
Lower noise level by 15-25 dB at street level	Noise levels above track grade not reduced
Increased structural integrity	Further decreases in sunlight
Reduced corrosion and "rust drop"	Major structural modifications required for extended use would necessitate interrupted Orange-Line Service
Replacement service would not be a requirement if existing station spacing is adequate	Construction impacts: -rust scrapings -paint spatter and odor -traffic disruption -interrupted Orange-Line Service -increased noise -material hauling
Entire Penn Central right-of-way would be provided for intercity and commuter rails	Increased structural loads and therefore reinforcement and new structure drainage system required due to noise barriers

Benefits	Disbenefits
	Back Bay and South Cove areas would not be served by rapid transit. There would be no direct connection from AMTRAK and Commuter rail to the Orange-Line downtown distribution system.
	Does not provide for direct connection from Amtrak and Commuter rail to North Station area
	Reduces viability of developing land cleared for I-95 south
	13.3 million dollars existing South Cove tunnel would not be utilized
	Continued use of portal would preclude planned expansion of Tufts N.E. Medical Center and new housing in South Cove Urban Renewal Center. Existing vibrations would continue to impact Medical Center Laboratory.
	Frequent local South End service on Washington Street (stops every 2 to 3 blocks) would not be feasible due to elevated line.
	Redevelopment of land and structures on Washington Street remains difficult
	Less incentive to provide major service improvements to transit dependent Roxbury/Dorchester/Mattapan
	No improvements (noise reduction) to Penn Central Mainline railroad alignment would accrue as a part of transit project
	Reconstruction of the Penn-Central Mainline embankment still required.

4.5.2 Subway under Washington/Shawmut

Reconstruction of the Orange Line in a subway basically in the vicinity of its current alignment was studied in detail with factors as indicated below:

Benefits	Disbenefits
Removal of Orange Line Elevated -eliminate major source of noise -eliminate major source of vibrations -eliminate blighting influence of structure -improve traffic operations and safety on Washington Street	Construction impacts -cut-and-cover south of Dudley -all material entering and leaving site must be hauled through communities by truck -property takings -traffic disruption -estimated cost $370,000,000 -temporary noise impacts

Benefits	Disbenefits
Replacement service would not be a requirement if existing station spacing is adequate	Operational deficiencies -under-and-over station at Dudley -separation of inbound from outbound transit north of Dudley Station
Entire Penn Central right-of-way could be provided for intercity and commuter rail	Back Bay and South Cove areas would not be served by rapid transit. There would be no direct connection from AMTRAK and commuter rail to the Orange Line downtown distribution system
Reduced running times for Orange Line transit	Reduces viability of developing land cleared for I-95 south
Lower operating and maintenance costs ($2 million/yr. less) of subway compared to elevated	Alternative does not create a significantly expanded ridership market compared to project cost
	Lower user benefit for subway as compared to relocation of Orange Line to P. C. Corridor ($3.4 million/yr. travel time savings vs. $4.8 million/yr)
	Reconstruction of Penn-Central Mainline embankment still required for AMTRAK.

Detailed engineering studies are presented in the Appendix. In addition, information relating to ridership, user benefit and operating costs is contained in Section 4.4.1.4.

All of the subway alternatives would connect to the new South Cove tunnel and station. These alternatives included:

South Cove to Dudley

- Twin shield-driven, single-track tunnels under Shawmut Avenue.
- Shield-driven, singel-track tunnels under Washington Street and Shawmut Avenue ("one-way pair").
- Cut-and-Cover subway under Shawmut Avenue.
  - -Side-by-Side
  - -Under-and-Over
- Single shield driven, twin-track tunnel under Washington or Shawmut.

Dudley to Forest Hills

- Twin-shield driven, single-track tunnels under Washington Street.
- Single-shield driven, twin-track tunnel under Washington Street.
- Cut-and-Cover subway under Washington Street.

4.5.2.1 Subway Route Description

The engineering feasibility of constructing an underground rapid-transit facility, while maintaining the existing Orange Line in operation, was studied for the construction methods and alignments listed above.

A refined alternative was selected which basically splits inbound and outbound transit service between East Berkeley Street and the general vicinity of Dudley Square. Both Washington Street and Shawmut Avenue are utilized to accomplish this. South of Dudley inbound and outbound Orange Line would be in the same basic alignment under Washington Street. The initial portion of the route would consist of twin shield-driven single-track tunnels (Fig. IV-99, Detail A). A station is proposed at East Berkeley Street, the narrow width of Shawmut Avenue precludes tunneling of two separate tunnels without incurring extensive underpinning for all abutting properties on both sides of the street. (Fig. IV-99, Detail B)

An alternative of twin track, cut-and-cover double box construction was also studied for this segment. This form of construction would require that the street would be completely disrupted from curb to curb, and would also entail extensive utility relocations (Fig. IV-99, Detail C). Furthermore, station layouts for side and center platform arrangements would only be feasible if the entire street width (from building line to building line) were disrupted, and platform widths less than desirable would have to be adopted.

Twin-track single-shield construction was also studied for this line segment. This option, though less threatening to the building foundations along Shawmut Avenue, would require property taking at stations.

For these reasons, the most feasible alternative is to tunnel under Shawmut Avenue using a single shield-driven tunnel (Fig. IV-99, Detail D) outbound to Roxbury Street where Shawmut Avenue ends (at Dudley Square) and locate the inbound track on Washington Street (Fig. IV-99, Detail E).

The two tracks would then come together at Roxbury Street and Shawmut Avenue where the Dudley Square station would be relocated.

South Dudley Square, the route alignment would continue along Washington Street in an over-and-under double-box cut-and-cover arrangement because of the narrow curb-to-curb width of Washington Street in this reach (Fig. IV-99, Detail F). The over-and-under double-box arrangement would continue to Marcella Street at which point Washington Street widens out sufficiently to permit a twin-track box arrangement side-by-side. The side-by-side arrangement would continue to the end of Washington Street. A new Forest Hills station would be constructed below grade south of the point where the Arborway crosses the present elevated Orange Line. At this location the relocated route centerline would be shifted west of the present trackage. South of the Forest Hills Station a turnaround and switchback track could be utilized to connect the station to the present storage yard and shop area located at or above street grade. Provisions can also be made at this point to extend the route trackage southward, coming up to the grade of the existing Penn Central embankment.

A shield driven tunnel along Washington Street south of Dudley is considered undesirable due to the inability of the existing elevated Orange Line to withstand the potential settlement which generally accompanies this form of construction.

4.5.2.2 Ridership, User Benefit and Operating Costs

Ridership projections reveal that this alternative does not create an expanded market area of patrons as successfully as the Orange Line relocation alternative. When compared to the "no build" expected to board the subway in 1980. The expenditure necessary to attract these riders would be approximately $370,000,000. User benefits, derived from travel time saved, would accrue to the subway alternative at the rate of $3.4 million per year compared to $4.8 million per year for the relocated Orange Line.

Operating and maintenance costs, however, would be lower by about $2 million per year when compared to the no-build case. The alternative does not provide the close station spacing of the street level facility as requested at South End residents for Washington Street.

4.5.3 Arterial Street Decked over Rail/Transit(in the Depressed Alternative)(Roxbury Crossing to Jackson Square)

Placing of the Arterial Street directly over the rail/transit facilities, between Roxbury Crossing and Jackson Square, for the prime purpose of containing noise and increasing land parcels available for the Roxbury Community College site was investigated. This option proves to be undesirable due to several factors which include close proximity of Jackson Square and Roxbury Crossing Stations and the Crossing of Stoney Brook Culvert.

Due to the location of Stoney Brook in this area, large scale building construction is not contemplated on the land under existing Columbus Avenue. Therefore, the increase in parcel size made possible by a potential decked arterial, could not be used. A buffer zone or open space would, however, be feasible. The cost of the arterial street construction over the rail/transit increases substantially due to the structural deck required. In addition, the tunnel thereby created would be unable to allow passage of diesel powered locomotives without extensive ventilation.

With the rail-transit portion of the project depressed and Stoney Brook Culvert crossing that depression, station access would ideally be provided at existing street level. The cleared land in this segment is to the east of the Penn Central, therefore, dictating that the street should be built on the east side instead of over the transit. The close proximity of the Roxbury Crossing and Jackson Square stations, as well as the factors mentioned above, require that any decked street alternative curve sharply to align over the rails and curve back again to by-pass the transit stations and thus allow station access at existing street level.

Partial decking of two lanes on the east isde of the alignment was also studied for the purpose of improving roadway geometry but found undesirable from a noise-impact standpoint in that it would serve to direct the sound westward, toward Parker Hill and the adjoining Bromley-Heath housing project.

Lowering the station entrances and mezzanines to improve street geometery would involve a further depression of the rail/transit facility, and the Stoney Brook Culvert by approximately 12 feet.

A longitudinal splitting of the street (northbound and southbound) with stations provided in the median would involve additional land takings to the west of Roxbury Crossing and Jackson Square Stations and would hamper joint development potential.

Although decking of the depressed rail/transit with the arterial street appears to be not practical, it should be pointed out that at Mission Hill and Bromley-Heath Housing Projects, structural decking for noise shielding purpose is proposed. Light structural decks over a short longitudinal distance are also feasible at station areas for the purpose of joint development and open space uses.

4.5.4 Arterial Segment# 3 (Jackson Square to Forest Hills) West of Depressed Rail

The combination of an arterial street located to the west of a depressed rail/transit facility does not provide many benefits to the area between Jackson Square and Forest Hills. Other alternatives studied present more benefits to this segment.

In general, the right-of-way required for arterial configurations located to the west of the Penn Central does not directly serve the larger industrial parcels located to the east thereby making those parcels less attractive for continued use or redevelopment. In fact, such as alignment would impact existing cleared land parcels, located to the west, in a manner which renders them less useable for residential-related or open-space development. The Arterial-West scheme would place the open space and playfields adjacent to the new street thereby presenting more hazard to children than the Arterial-East scheme. In addition, the street would be closer to a larger number of houses which are located on the westerly side of the railroad. While there are some houses on the east, there is a predominance of industrial buildings which would not be affected by the proximity of the arterial street and which would benefit from improved access.

Under the Arterial-West alternative approximately 62 percent of the arterial's western boundary touches or is near residential land uses. Under the Arterial-East alternative approximately 25 percent of the arterial's eastern boundary touches or is near residential land uses.

With regard to geometric design, this arterial configuration is also less desirable since it must cross over from east to west of the depressed Penn Central in the vicinity of Atherton Street, just south of Jackson Square, then back to the east side just north of Forest Hills. In an effort to reduce the length and depth of the bridge structures required for the crossovers (thereby also minimizing the depth of rail depression) reverse curvature would have to be introduced to the street geometry.

In general, existing ground is at higher elevations on the western side of the Penn Central embankment. Therefore, any rail depression located to the east would be at a lower final elevation when compared to a westerly alignment. If the ground water in this area is at a constant elevation, an easterly rail depression would be more costly to build since it would have to be built deeper in the ground water.

4.5.5 Orange Line in Tunnel from Back Bay Station to Camden Street

The feasibility of continuing the Orange Line tunnel alternative (SC-2) to the south of Back Bay station was investigated. An evaluation was made regarding the reduction in noise levels expected for such an undertaking as well as its construction implications.

4.5.5.1 Construction Considerations

In this option, the Orange Line would be placed in a twin concrete box structure approximately 20 to 21 feet below present rail grade. The structure would be built on the eastern edge of the present 66-foot wide right-of-way, leaving the present two westerly tracks for commuter rail and AMTRAK operations. The eastern side of the right-of-way has been selected for the tunnel structure way line. However, the eastern abutments of all street and foot bridges would have to be underpinned.

In the vicinity of Massachusetts Avenue the Orange Line alignment would cross over to the western side to join a proposed station located between Massachusetts Avenue and Gainsborough Street on the western side of the existing right-of-way.

Immediately south of Massachusetts Avenue station, which will be of the center platform type, the track alignment remains adjacent to the western right-of-way and rises to grade by means of a "U" shaped open-cut structure. Track alignment in the vicinity of Massachusetts Avenue would require the rebuilding of the western abutment and deck of this street crossing, as well as the taking of a building on the north west corner.

If the Penn Central is to remain operative during construction within the alignment, the tunnel structure itself can only be built, in the narrow 66-foot right-of-way, by leaving the sheet-pile excavation supports in place and pouring the concrete side walls against the piling. This method permits narrowing of the construction trench which enables use of two tracks uninterrupted. In addition to the steel sheet piling left in place, part of the bracing system will also have to be incorporated in the transit tunnel structure.

Incorporating these techniques, the clearance from the centerline of the closest operative rail to the sheet piling line is only 8 - 1/2 feet which is marginally acceptable. A greater side clearance would require that the twin-box structure be shifted partially into Claremont Street.

4.5.5.2 Noise Considerations

See Section 5.5.

4.5.6 Depressed and Covered Rail/Transit in South End (Back Bay Station to Camden Street) (See Fig. IV-100, IV-101)

The existing rail depression between Back Bay Station and Camden Street is presently between 8 and 20 feet below adjacent street grades, with the present track grade rising toward the south. In the St. Botolph neighborhood, 7 houses have first-floor windows which face directly into the western side of the track bed. Existing peak noise levels caused by diesel locomotives currently exceed 110 decibels (dB).

One alternative considered incorporates depression of the entire rail/transit facility and decking it over with a structure which allows diesel smoke to filter through. The depressed structure would cover the five-track right-of-way but still allow light to the first floor windows of the row houses.

Noise considerations for this alternative is presented in Section 5.5.

4.5.6.1 Construction Considerations

In this option the Orange Line would be located on the western side of the right-of-way with AMTRAK and Commuter Rial (Railroad) retaining 3 tracks along the east. It is desired to place a noise suppressing structure over and around the proposed depressed five-track right-of-way, while providing a 17' - 9" structure clearance for the Railroad and not having the cover structure obstruct the window sill level of the houses mentioned above. These criteria can be satisfied by lowering the present track grade by approximately 9 feet in the vicinity of Massachusetts Avenue. Provisionally, this depth of cut has been maintained throughout the reach.

The 9-foot track depression requires that all houses on the western right-of-way line be supported. The support of these houses has been integrated with the support of the excavation cut by use of tied-back slurry walls. The walls would be excavated in 8-to-12-foot-long alternating sections on both sides of the proposed deepened cut. Initially, the west wall would be built, permitting the use of the two easterly tracks for railroad operations. In this case, the eastern most track, which is currently in disrepair, would have to be rehabilitated.

The deepening of the right-of-way would proceed in two stages, with the eastern half deepened first. The eastern face of the first-stage excavation would be supported by a steel-sheet pile wall, cross braced to the western slurry wall as excavation proceeded.

At the bottom of the excavation a track drainage system would be installed, topped by a substantial reinforced concrete base slab to resist

uplift pressures. After the first half of the deepening has been completed the second or easterly part can proceed.

Since the slurry walls are 30 inches wide, a 3-foot strip of property to the east of the eastern right-of-way would have to be acquired permanently. For the main part, this taking is confined to the bed of Claremont Street which adjoins the western right of-way line. Exceptions to this are the two building properties on either side of Massachusetts Avenue which will have to be acquired and demolished.

In addition, a 3-foot segment of Titus Sparrow Park would have to be acquired. This park is currently under construction. As such, it does not yet qualify as a 4(f) property. A request has been made of the City of Boston through its Redevelopment Authority for a 4-foot (plus construction) easement.

4.5.7 Rail Service Continued in Penn Central Corridor During Construction

The implications of continuing railroad service in all alternatives during construction was analyzed and discussed at several public meetings with commuter rail riders and residents of the project area. Because of the high cost, disruption to all railroad service and schedules caused by construction process delays, and the prolongation of the construction period, these alternatives were rejected. Instead, it is proposed that rail service be temporarily diverted to the Midland Division or substituted by bus service in the manner described in Section 6.2.9.1. The problems associated with the continuance of rail service by means other than diversion of service to Midland Division are described in detail below.

4.5.7.1 Depressed Alternatives

Two options were investigated. Option A: partial excavation of the present embankment while maintaining rail service on that portion of the railroad embankment that temporarily stays up. Option B: shifting railroad service to a temporary trestle constructed on that land scheduled to be used for Arterial Street purposes.

Operating the railroad on an adjacent temporary track at street level would be dangerous even though lights and gates were provided. In addition, existing utilities are at shallow depth and could not withstand rail traffic loadings. At crossings, these utilities would possibly rupture. From a safety point of view alone, this choice was eliminated from further consideration.

Under "Option A", it would be necessary to drive a continuous wall of steel sheeting between the existing two center tracks. The sheeting would be of sufficient length to both support the present railroad embankment and permit partial excavation of the transit depression. Since the depression goes below the present groundwater table, extensive shoring and support of the sheeting is required so as to preserve the integrity of the embankment. Careful monitoring of the sheeting and shoring would be necessary during dewatering of the depression as this is the time when soil conditions are most subject to movement. Any movement would seriously endanger the embankment's capability to safely carry trains.

At all cross streets temporary bridges would be required to cross the first-stage excavation of the depression so that vehicular traffic remains undisturbed.

Construction staging of this sort would require that large pieces of construction equipment would have to work immediately adjacent to an operating railroad track. Construction equipment within 12 feet of a track (which will be necessary under this option) fouls the track and under railroad regulations, precludes passage of a train. Such a train cannot pass until such time as the construction equipment is moved away from the active track. This difficulty will cause the slowing of railroad trains to a restricted speed through the construction area as well as lengthen the construction time.

Upon completion of the first longitudinal depressed section of the facility, train traffic could be diverted to the depression and the process repeated for removing the remaining half of the embankment.

Such a construction staging program would add extensive time periods and extra cost to the total project as well as cause passenger railroad delays due to slower operating speeds. In addition, construction impacts would be more severe. Substantial problems relative to maintaining safe train operations and safe working conditions render this option marginally feasible.

"Option B", which would utilize the construction of a temporary two-track trestle for interim commuter rail operations, is the more viable option.

The construction of a temporary trestle would occupy the space presently intended for Arterial Street purposes. While such an option provides for safe train operations and safe working conditions, it also materially adds to the length of the total construction program. The temporary trestle would have to be constructed to accept diverted rail traffic during construction, then completely dismantled before the proposed arterial street can be built.

With either of the foregoing options, the constraints of constructing a new facility within the confines of Back Bay Station remains difficult. It presently appears likely that no more than one track could be maintained active in Back Bay Station area - and this track would require continual shifting to accommodate construction procedures. It is highly likely that Back Bay Station schedules, therefore, would have to be revised to fit into a single track operation. Patrons using Back Bay Station under such conditions would likely be subject to delays and would suffer inconveniences due to construction procedures.

Alternatives to continuing all service at Back Bay during the construction period include a partial deversion of at least AMTRAK service and deadhead runs (empty trains in counter-peak direction) to the Penn Central Midland Division. This alternative would relieve the demand for the single track through Back Bay, the point of greatest construction. This would provide a single track in the peak direction with a probable capacity of a 10 minute headway, or 6 trains/hour. Some alternate routing of trains in a "non stop" to South Station mode is also possible, though this would reduce the service alternatives for Back Bay bound riders while increasing the ease of travel for South Station bound passengers.

The preliminary estimated cost for a temporary 2 track trestle is $53,260,000 plus 30 percent for engineering and contingencies.

4.5.7.2 Embankment Alternatives

The raising of the present railroad embankment, while maintaining active rail operations on 2 tracks, can be accomplished in a reasonable manner for those areas between existing bridges that overpass streets. The difficulty comes about when 2 active tracks must be maintained on the

present bridge structure while the remaining half of the bridge is demolished to permit construction of the new higher, wider and longer span bridge.

To accomplish such an operation would necessitate the driving of steel sheet piling adjacent to the 2 active tracks for a length in excess of the length of the proposed new rail/transit bridge. However, at the immediate existing bridge site it would not be possible to drive steel sheeting down through the present granite abutment to facilitate removal. Rather, the existing granite blocks would have to be carefully removed and the remaining portion of the abutment shored and braced in an effort to protect its structural integrity. Undoubtedly this would be a time consuming process and provide a less than desirable construction area for the first half of the new rail/transit bridge.

Should such a scheme be ultimately deemed desirable, an extensive evaluation of the condition of the existing railroad bridge will be necessary. It is not presently known whether or not the present steel spans are so constructed as to lend themselves to longitudinal separation of the midpoint. A total examination of the original steel design together with an analysis of present steel condition is required. Considering the age of the existing railroad bridges, their present condition may very well preclude partial dismantling to permit new staged construction.

A second option which is feasible for the embanked alternatives is the temporary 2 track trestle system which was described earlier.

4.6 Relationship to Other Projects

Several other projects are under discussion for the Southwest Corridor, areas within the City of Boston, as well as suburban communities. A description and consideration of each is included below. The projects which are currently included in the Unified Work Program for the Boston Region, or are in design or construction are:

4.6.1 The Proposed Improvements to the Needham Branch Railroad

The proposed improvements to the Needham Branch railroad may take the form of new improved railroad commuter service or extension to the Orange Line transit system to Needham and route 128 respectively. Should the new service be commuter rail, the opportunity to negotiate an easy transfer to the Orange Line at Forest Hills will be provided as well as affecting an Orange Line transfer for continuation of an inner-city trip. Should the Needham Branch be converted to Orange Line service the capability will newly be provided for a single line trip from Route 128 Needham, to and through the City of Boston and on to the Oak Grove station on the recent Orange Line North extension at the Malden-Melrose Town Line. Heretofore, such a trip has never been possible. A transfer to the Green Line will be possible under all alternatives at Forest Hills.

The South Cove-Forest Hills project and its relationship to the decision making process for the West Roxbury/Needham project beyond Forest Hills can be addressed in four areas: 1) consistency with environmental requirements; 2) consistency with Federal capital programming requirements; 3) consistency with State capital programming requirements; and 4) consistency with design of the Forest Hills Station.

These four areas are discussed below. However, it is worthwhile to briefly review the analysis documented in the Environmental Impact Statement towards the timing of the Needham Branch project decision. First of all, in the section on Analysis of Alternatives (section 4.3.2), the E.I.S. examines the proposed configuration - two rapid transit tracks and three railroad tracks - for its compatibility with four separate planning scenarios.

The proposed configuration and its alternatives were examined both with the assumption that rapid transit would be extended through Roslindale and West Roxbury, and with the assumption that it would not be extended. Further, the proposed project was examined with the assumption that the commuter rail ridership would expand only modestly, and with the assumption it would expand tremendously.

This exercise, as included in the report, concluded that three rail tracks were desirable in the most modest assumption about the future of commuter rail (i.e., low ridership, rapid transit service to Needham), and fully adequate in the highest assumption about the future of commuter rail service (i.e., major increases on all lines, with CRR service to Needham). The reader is referred to pages 4-16 to -21 for this analysis.

Based on this compatibility with either Needham decision, the Massachusetts Executive Office of Transportation and Construction has stated its intention to undertake at least a reconstruction of a two-track rail roadbed on the Needham Branch during the period of rail service disruption. The decision as to the timing and scale of further upgrading of service on that Branch will be made at the conclusion of the Roslindale/West Roxbury/Needham Transit Improvements Study, and as part of the revised capital plan for the Authority, called the "Program for Mass Transportation".

The implications of making these two decisions in a staged rathed than simultaneous manner are discussed below.

1. Consistency with Environmental Requirements

Under present interpretation of environmental requirements, every proposed transit project must be evaluated for its impacts in and of itself. That is to say, in the justification of a given transit project, you cannot assume the existence of a second project which has not as yet cleared the environmental impact statement process. By way of an example to clariy this concept, the MBTA has proposed a major transit facility in the Alewife Brook area of Cambridge. In order to minimize the negative impacts of auto vehicle congestion gaining access to the Alewife facility, the Department of Public Works plans to build a roadway ramp system in the area. However, the transit E.I.S. could not assume that the second project - the highway ramp project - would be in existence at the time of opening of the transit station. The transit line had to be documented in terms of its impacts in and of itself, without assuming the existence of a second project which might mitigate the environmental disruption of the proposed project.

Thus, even if the Roslindale/West Roxbury/Needham study were completed today, the South Cove-Forest Hills E.I.S. would have to take the same form as presented in the July hearing. It would not be able to assume any particular Needham facility, but rather show its compatibility with either of the main options for service in the Roslindale/West Roxbury/Needham corridor.

In as much as the proposed Southwest Corridor Project is a self-sustaining project which protects all options for the Needham Branch as well, no environmental inconsistency exists.

2. Consistency with Federal Capital Programming Requirements

In a major policy development in the fall of 1975, the Urban Mass Transportation Administration announced the adoption of a policy towards investment in major "fixed-guideway" projects (such as rapid transit or

commuter rail facilities). In that policy, it was stated that while long term planning should examine total systems, projects being submitted for capital funding must be broken down into separately implementable sub-projects, called useable segments. These projects must, according to this policy, be justifable in and of themselves, without the assumption of further major capital investment. In the replacement of the Washington Street elevated to Forest Hills, the "useable segment" in the case of this project is the facility to Forest Hills. This project must be justified on its own merits before the Roslindale/West Roxbury/Needham project can be considered, according to Federal funding policy.

It should be noted that the UMTA policy of incremental justification of staged implementation of major projects is similar in form to the environmental requirements noted above. However, they are in fact two separate issues: one related to the National Environmental Policy Act; and the other related to capital programming requirements based on the principle of marginal economic analysis. Both criteria are satisfied in the Southwest Corridor Project - South Cove to Forest Hills.

3. Consistency with State Capital Programming Requirements

It is a hard fact that the Commonwealth of Massachusetts could not implement all desirable projects at once, and in fact must stage the improvements over time. (This is the process of Capital Programming.) The decision concerning the choice of mode for the Roslindale/West Roxbury/Needham corridor will, of necessity, be influenced by the cost of other major capital projects, including the South Cove-Forest Hills project. The final project costs of the South Cove-Forest Hills project (as well as other major transit projects) are a critical input to that capital budgeting process. For programming purposes, the decision on definition and timing of rail transportation improvements to Roslindale, West Roxbury and Needham has been placed by the State in the content of the "Revised Program for Mass Transportation," the required long term capital budget for Mass Transportation. A draft of the document will be circulated in late 1976 or early 1977.

4. Consistency with Design of the Forest Hills Station

The proposed design for the joint facility is consistent with both major options for Roslindale/West Roxbury/Needham rail service. The design of the Forest Hills station area has been programmed with awareness of the need for flexibility in the evolution of service improvement. Specifically, the project has rejected design alternatives which would rule out direct connection to the Needham line R-O-W for either mode. Rather, the proposed design solution calls for the rapid transit "tail tracks" to veer onto the Needham Branch alignment, with sufficient horizontal clearance for two commuter rail tracks to parallel them. These four tracks would be utilized in either case because of the need to have a small amount of rapid transit car storage in this location for "short turn-back" service from Forest Hills or for full end-of-line storage.

The only design aspect which is then impacted by the necessity of staging the two project decisions is the scale of the parking facility at Forest Hills. Studies show that demand for parking at Forest Hills would be decreased by a rapid transit extension through Roslindale and West Roxbury, but not eliminated. A significant portion of the parkers using both the current parking lots and the proposed facility at Forest Hills approach along Hyde Park Avenue, or from the circumferential parkways. Neither of these segments of the market would be significantly diminished by an extension along the Needham branch which runs west from Forest Hills and not south to Hyde Park. A facility of 500 cars is proposed for the roof of the Forest Hills station. This parking would be required primarily as replacement for the on-grade parking which will be lost in the Forest Hills area due to the proposed Southwest Corridor project. A detailed analysis of these requirements is included in Appendix J of this E.I.S.

It is correct, however, that the final determination of the scale of the parking facility should be made after the decision concerning the timing of the rail improvements on the Needham Branch. This can be accomplished prior to design of the station, or the station can be designed to take the loading of the two additional parking levels necessary for the full demand indicated.

4.6.2 The Proposed New High Speed Northeast Corridor Rail Service

The proposed new high speed Northeast Corridor rail service will terminate at South Station. This will provide service to New York and Washington via Back Bay. The approved South Cove Tunnel Extension Project will, when completed, convey the train patron from South Station to North Station via rapid transit for a continuation of a railroad trip to the north. By virtue of the proposed Relocated Orange Line service, the high speed railroad patron will be able to disembark at Back Bay station and utilize Orange Line Rapid Transit to locations within Roxbury and Jamaica Plain with only one transfer.

The proposed new high speed Northeast Corridor rail service will terminate at South Station and other service to New York and Washington at Back Bay. The approved south cove tunnel extension project will, when completed, convey the train patron from South Station to North Station for a continuation of a railroad trip to the north. By virtue of the proposed Relocated Orange Line service, the high speed railroad patron will be able to disembark at Back Bay Station, utilize Orange Line Rapid Transit to locations within Roxbury and Jamaica Plain with only one transfer.

During the past twelve months, several discussions and exchanges of schematic drawings and draft agreements have taken place among Amtrak, the Federal Railroad Administration, the Massachusetts Secretary of Transportation and the MBTA regarding the Southwest Corridor Project. These deliberations have sought to create a Memorandum of Agreement governing the coordination of the Northeast Corridor Project and the Southwest Corridor Project as described herein. The scope of this Agreement will include the following elements:

- Dorchester Branch (Midlands Division) Detour Route: The use of the Midland Division during construction.
- Operating Policy: Dispatching and scheduling rights, priorities and resolution of disputes.
- Utility: Performance standards and track allocation.
- Capacity: Future use of trackage.
- Cost Allocation Principles: South Cove to Forest Hills.
- Timing and Project Coordination: Responsibility for design and construction; electrification of the Midland Division.

Negotiations in the creation of the Agreement are ongoing, and will be included in the final E.I.S. for the Southwest Corridor Project.

4.6.3 The Proposed Commuter Rail Upgrading

The proposed commuter rail upgrading will enable the railroad patron from the Franklin and Stoughton Branches to interface with proposed Orange Line Stations at Forest Hills, Ruggles/Northeastern and Back Bay. Forest Hills will provide the efficient transfer to either Orange Line or Green Line service. Ruggles/Northeastern station is located at the junction of possible future circumferential transit. Should this become a reality, the railroad patron will be afforded the opportunity to make a previously unavailable circumferential trip to the educational-hospital complex in Boston. Back Bay Station of course will permit the rail commuter to transfer to the Orange Line for an inner city trip or a make connection to North Station for an ongoing northerly railroad trip.

4.6.4. South End/Roxbury/Dorchester/Mattapan Transportation Improvements

The MBTA has submitted a proposed consultant contract for approval to UMTA for an investigation of project alternatives and production of Environmental Impact Statement for improved transit service to these communities.

4.6.5 Circumferential Transit

The Central Transportation Planning Staff (CTPS) is currently investigating alternatives for cross-town transportation in the institution-residential-industrial ring through Boston, Cambridge and Somerville in preparation for an Environmental Impact Analysis. The Southwest Corridor project provides right-of-way reservation for this project in Lower Roxbury.

4.6.6 Green Line Improvements

New equipment, station modernization, power and communications projects are at various stages of development. The present Orange Line/Green Line configuration at Forest Hills requires that a passenger transferring from one line to the other must disembark and walk thorugh a heavily travelled, dangerous street complex to affect the transfer. The proposed Orange Line Relocation with its new Forest Hills Station will relocate Green Line service to the proposed new Forest Hills Station. Such an arrangement will provide new under cover cross-platform service between the Orange Line and Green Line services.

The ability to relate the Green Line into the proposed new Forest Hills Station complex further provides the capability to make under-cover transfer to both the commuter train and bus thus reinforcing the area transportation network.

4.6.7 South Cove Transit Station and South Cove Tunnel Extension

A capital grant has been received by MBTA to complete the South Cove Station envelope tunnel and to provide service to Back Bay Station. The Orange Line can be fully relocated to the Penn Central corridor to provide the required interface for service to be extended from Back Bay to Forest Hills.

4.6.8 The Proposed Upgrading of the Midland Branch Railroad

The proposed upgrading of the Midland Branch Railroad has been approved for capital grant to the MBTA. It has an equally important long range relationship in that the Midland Branch will be able to provide local railroad service and can act as a railroad relief valve during emergencies and peak periods on the mainline. The ability to deadhead trains back out to the suburbs during the in-bound peak will reduce rolling stock requirements and expand capacity. It is of vast importance in providing the capability to continue mainline rail service to Boston's South Station during the reconstruction of the Penn Central corridor.

4.6.9 New Orange Line Cars

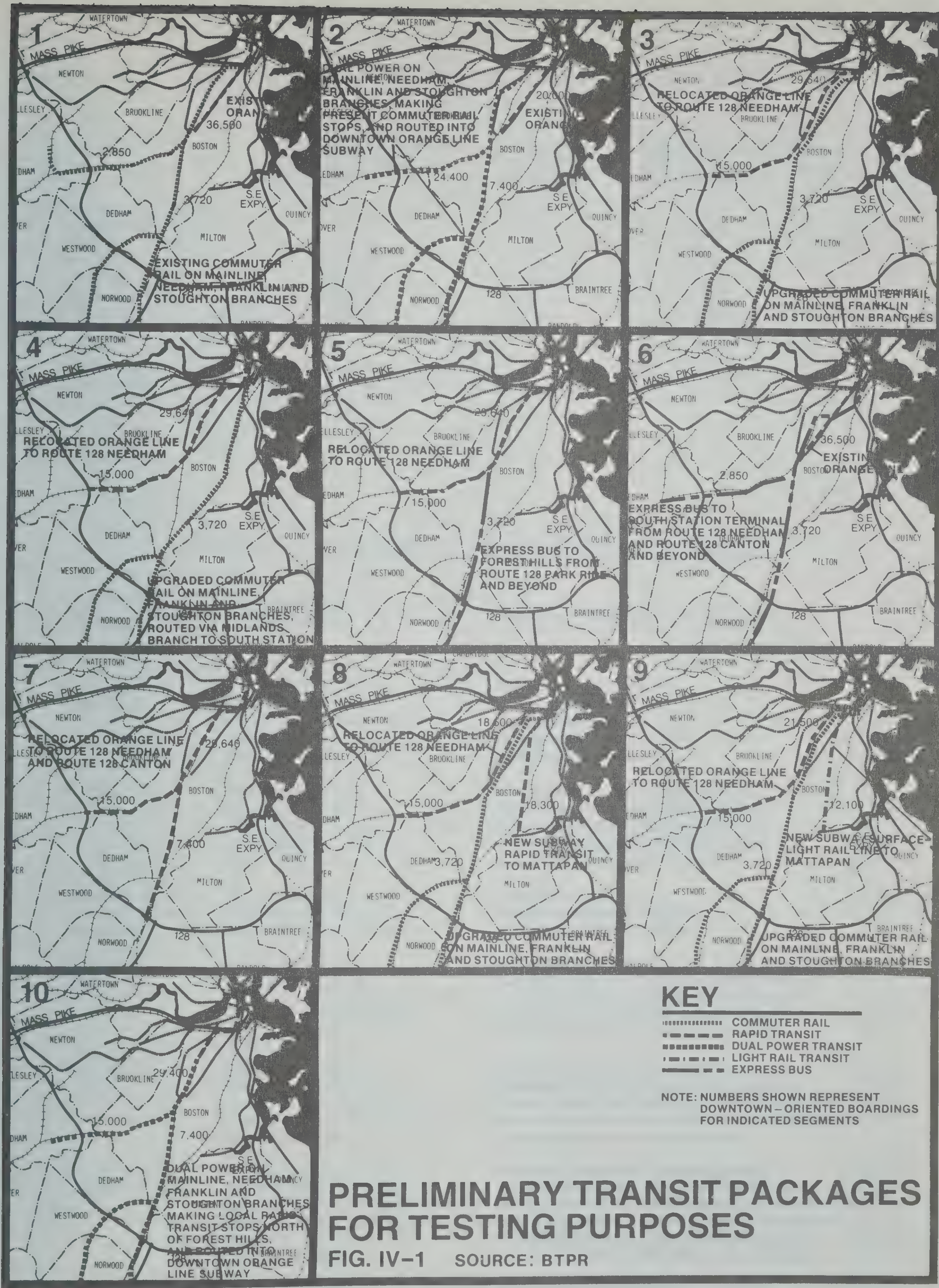
Capital Grant has been recieved by the MBTA for the purchase of additional cars for the Orange Line.

4.6.10 Orange Line North

Service as initiated in 1975 on the new alignment for Haymarket Station to Malden Center with intermediate stations at Community College, Sullivan Square and Wellington. Service to Malden Center Station is now in operation.

4.6.11 Other Related Transit Improvements

Other related transit improvements, such as the Arborway Bus Garage and operating improvements are described in the Transit Development Plan of the MBTA.



PRELIMINARY TRANSIT PACKAGES FOR TESTING PURPOSES

FIG. IV–1 SOURCE: BTPR

(FIG. IV-2)

"BEHAVIORAL" TIME AND SPEED FOR SOUTHWEST SERVICE AREAS

(BTPR)

Service Area	Behavioral Travel Time to CBD* (weighted min.)	Distance to CBD (mi.)	Average Behavioral Speed (mph)
Dudley & Vicinity	25.8	3.0	7.0
Forest Hills	34.3	5.3	9.3
Roxbury Crossing	40.5	3.0	4.4
West Roxbury	67.3	7.6	6.8
Needham	77.8	10.6	8.2
Route 128 Canton	72.0	12.1	10.1
Franklin Park-Mattapan	46.5	5.2	6.8

*These travel-time estimates are consistent with one another but do not fully reflect distribution times and therefore are somewhat low.

(FIG. IV-3)

PERCEIVED TRAVEL SPEEDS FOR SOUTHWEST TRANSIT ALTERNATIVES

Service Area	Improvement Alternative	Average "Behavioral Speed" (MPH)
Dudley Area	Existing R.T.	7.0
	Relocated R.T.	5.5
	Dual Power Vehicle	5.6
	Mattapan R.T.	7.0
	Light Rail	6.8
Forest Hills	Existing R.T.	9.3
	Relocated R.T.	10.1
	Dual Power Vehicle Expr.	10.6
	Dual Power Vehicle	10.2
	Express Bus	8.7
Roxbury Cros-sing/Jackson Square	Existing R.T.	4.4
	Relocated R.T.	7.5
	Dual Power Vehicle	7.6
West Roxbury	Commuter Rail	6.8
	Relocated R.T.	12.0
	Dual Power Vehicle Expr.	11.3
	Dual Pwer Vehicle	11.5
	Express Bus	10.9
Needahm	Commuter Rail	8.2
	Relocated R.T.	11.3
	Dual Power Vehicle Expr.	12.5
	Dual Power Vehicle	12.7
	Express Bus	9.4
Readville & Beyond	Commuter Rail	10.1
	Relocated R.T. Ext.	11.6
	Dual Power Vehicle Expr.	13.4
	Dual Power Vehicle	12.5
	Bus to R.T.	11.0
	Express Bus	11.7
Franklin Park/Mattapan	Existing R.T.	6.8
	Mattapan R.T.	9.5
	Mattapan Lt. Rail	8.5

Source: BTPR

(FIG. IV-4)

ANNUAL NET BENEFITS
OF TRANSIT PACKAGES
($ Millions)

Packages	Net Change in Cost	User Benefit	Net Benefit
2. Dual power vehicle replacing all commuter rail, existing Orange Line retained.	4.0	9.8	5.8
3. Orange Line to Route 128-Needham, commuter rail to the south via Mainline.	0.2	11.6	11.4
4. Orange Line to Route 128-Needham, Commuter rail to the south via Dorchester Branch of the Midlands Division.	0.2	11.6	11.4
5. Orange Line to Route 128-Needham, express bus from Forest Hills to Route 128 Canton	-1.5	11.7	13.2
6. Express bus from South Station to Route 128 Needham and 128-Canton, existing Orange Line.	-3.0	7.0	10.0
7. Orange Line to Route 128-Needham, Orange Line to Route 128-Canton.	0.6	11.9	11.3
8. Orange Line to Route 128-Needham, Orange Line to Mattapan.	3.2	15.0	11.8
9. *Orange Line to Route 128-Needham, commuter rail to the south, Green Line (light rail) to Mattapan.	0.1	13.9	13.8
10. Dual power vehicle replacing all commuter rail; no other line-haul transit.	0.6	11.9	11.3

Source: BTPR

*BTPR's selected Alternative Program Package

(FIG. IV-5)

ESTIMATED INBOUND BOARDINGS AND LINE VOLUMES - "NO BUILD" SYSTEM, SOUTHWEST CORRIDOR (UNCONSTRAINED BY PARKING CAPACITIES) 1/5/76.

Station	1980 Peak Period[1] Boardings	Offs	Line Vols	1980 24-Hour Boardings[2]	Offs[3]	Line Vols	1995 24-Hour Boardings	Offs	Line Vols[4]
Forest Hills	8094	0		13760	0		14850	0	
			8094			13760			14850
Green Street	776	13		1860	35		1825	35	
			8857			15585			16640
Egleston	1700	77		3660	210		3555	200	
			14480			19035			19995
Dudley	3810	502		8390	1045		8090	1010	
			13788			26380			27075
Northampton	1214	585		3450	1665		3385	1645	
			14417			28165			28815
Dover	550	1120		2200	2150		2270	2125	
Total	16144	2297	13847	33320	5105	28215	33975	5015	28960

1. Peak period is 7 AM to 10 AM
2. Inbound boarding passengers
3. Inbound alighting passengers
4. Inbound line segment (station to station) volume

(FIG. IV-6)

ESTIMATED UNCONSTRAINED STATION BOARDINGS BY ACCESS MODE AND ZONES OF ORIGIN - "NO BUILD" SYSTEM, SOUTHWEST CORRIDOR 1/5/76

Station Name: Forest Hills
Alternative: No Build

City or Town or Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Brookline	0	84	87	21	192	288	300
Canton	0	0	0	54	54	65	83
Dedham	0	326	41	342	709	922	996
Dorchester	0	224	22	39	285	482	472
Dover	0	0	0	85	85	102	122
Foxborough	0	0	0	68	68	75	84
Hyde Park	0	950	70	140	1160	2090	2257
Jamaica Plain	676	403	22	20	1121	2281	2240
Medfield	0	0	0	80	80	96	119
Millis	0	0	0	14	14	17	22
Milton	0	0	0	63	63	82	87
Needham	0	0	0	137	137	178	194
Newton	0	0	3	17	20	26	27
Norwood	0	143	10	225	378	492	550
Randolph	0	0	0	15	15	18	25
Roslindale	81	1605	76	58	1820	3458	3804
Roxbury	2	10	0	0	12	20	19
Sharon	0	0	0	16	16	19	21
Sherborn	0	0	0	16	16	19	31
Walpole	0	0	0	75	75	90	115
West Roxbury	0	1097	75	104	1276	2297	2481
Westwood	0	250	10	195	455	591	739
Other	0	0	8	35	43	52	62
Total	795	5092	424	1819	8094	13760	14850

(FIG. IV-6) (Continued)

ESTIMATED UNCONSTRAINED STATION BOARDINGS BY ACCESS MODE AND ZONES OF ORIGIN - "NO BUILD" SYSTEM, SOUTHWEST CORRIDOR 1/5/76

Station Name: Green Street
Alternative: No Build

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Jamaica Plain	680	69	10	17	776	1860	1825
Total	680	69	10	17	776	1860	1825

Station Name: Egleston
Alternative: No Build

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Dorchester	0	386	66	0	452	970	952
Jamaica Plain	507	87	0	0	594	1280	1252
Roxbury	525	123	6	0	654	1410	1351
Total	1032	596	72	0	1700	3660	3555

Station Name: Dudley
Alternative: No Build

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Dorchester	0	424	0	0	424	930	910
Jamaica Plain	51	0	0	0	51	110	108
Parker H/Fen	0	115	0	0	115	250	252
Roxbury	862	2262	96	0	3220	7100	6820
Total	913	2801	96	0	3810	8390	8090

Station Name: Northampton
Alternative: No Build

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Boston Proper	446	3	0	0	449	1280	1320
Dorchester	0	38	0	0	38	90	88
Parker H/Fen	0	16	0	0	16	46	47
Roxbury	325	20	0	0	345	990	950
South Boston	49	317	0	0	366	1044	990
Total	820	394	0	0	1214	3450	3395

Station Name: Dover
Alternative: No Build

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Boston Proper	550	0	0	0	550	2200	2270
Total	550	0	0	0	550	2200	2270

(FIG. IV-8)

ESTIMATED INBOUND BOARDINGS AND LINE VOLUMES - "RELOCATED" SYSTEM, SOUTHWEST CORRIDOR (UNCONSTRAINED BY PARKING CAPACITIES) 2/23/76

	1980 Peak Period			1980 24-Hour			1995 24-Hour		
Station	Boar-dings	Offs	Line Vols	Boar-dings	Offs	Line Vols	Boar-dings	Offs	Line Vols
Forest Hills	8594	0	8594	14585	0	14585	15780	0	15780
Green Street	969	13	9550	2330	35	16880	2285	35	18030
Boylston	879	46	10383	2110	115	18875	2070	115	19985
Jackson Square	2530	161	12752	6580	400	25055	6380	400	25965
Roxbury Crossing	2131	256	14627	5330	640	29745	5190	630	30525
Ruggles Street	2325	235	16717	7680	590	36835	7500	580	37445
Mass. Avenue	1219	504	17432	3650	1260	39225	3630	1250	39825
Back Bay	1245	2540	16137	8715	3810	44130	9150	4000	44975
South Cove	917	1397		4585	3710		4725	3820	
TOTAL	20809	5152	15657	55565	10560	45005	56710	10830	45880

(FIG. IV-9)

ESTIMATED UNCONSTRAINED STATION BOARDINGS BY ACCESS MODE AND ZONES OF ORIGIN - "RELOCATED" SYSTEM, SOUTHWEST CORRIDOR 2/23/76

Station Name: Forest Hills
Alternative: Relocated

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Brookline	0	89	94	24	207	310	324
Canton	0	0	0	60	60	72	92
Dedham	0	350	43	370	763	992	1072
Dorchester	0	230	24	42	296	500	490
Dover	0	0	0	92	92	113	133
Foxborough	0	0	0	69	69	76	85
Hyde Park	0	986	83	155	1224	2200	2376
Jamaica Plain	690	406	22	20	1138	2310	2274
Medfield	0	0	0	81	81	97	120
Millis	0	0	0	14	14	17	22
Milton	0	0	0	65	65	85	90
Needham	0	0	0	150	150	195	213
Newton	0	0	3	18	21	27	28
Norwood	0	145	10	227	382	497	557
Randolph	0	0	0	15	15	18	25
Roslindale	90	1760	86	65	2001	3802	4183
Roxbury	3	11	0	0	14	23	22
Sharon	0	0	0	17	17	20	22
Sherborn	0	0	0	17	17	20	32
Walpole	0	0	0	80	80	96	123
West Roxbury	0	1165	80	115	1360	2430	2640
Westwood	0	265	11	207	483	630	790
Other	0	0	9	36	45	55	67
Total	783	5407	465	1939	8694	14585	15780

(FIG. IV- 9) (Continued)

ESTIMATED UNCONSTRAINED STATION BOARDINGS BY ACCESS MODE AND ZONES OF ORIGIN - "RELOCATED" SYSTEM SOUTHWEST CORRIDOR 2/23/76

Station Name: Green Street
Alternative: Relocated

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Jamaica Plain	827	112	11	19	969	2330	2285
Total	827	112	11	19	969	2330	2285

Station Name: Boylston Street
Alternative: Relocated

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Dorchester	0	0	26	0	26	62	60
Jamaica Plain	793	0	36	0	829	1990	1954
Roxbury	24	0	0	0	24	58	56
Total	817	0	62	0	879	2110	2070

Station Name: Jackson Square
Alternative: Relocated

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Dorchester	0	231	0	0	231	600	590
Jamaica Plain	303	408	20	0	731	1900	1860
Parker H/Fen	3	76	0	0	79	205	210
Roxbury	99	1304	86	0	1489	3875	3720
Total	405	2019	106	0	2530	6580	6380

Station Name: Roxbury Crossing
Alternative: Relocated

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1989 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Dorchester	0	268	0	0	268	670	660
Parker H/Fen	294	163	0	0	457	1145	1155
Roxbury	62	1218	126	0	1406	3515	3375
Total	356	1649	126	0	2131	5330	5190

Station Name: Ruggles Street
Alternative: Relocated

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1989 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Dorchester	0	40	10	0	50	175	170
Parker H/Fen	430	219	20	0	669	2340	2370
Roxbury	101	1427	78	0	1606	5615	5390
Total	531	1686	108	0	2325	8130	7930

(FIG. IV- 9) (Continued)

ESTIMATED UNCONSTRAINED STATION BOARDINGS BY ACCESS MODE AND ZONES OF ORIGIN - "RELOCATED" SYSTEM, SOUTHWEST CORRIDOR 2/23/76

Station Name: Massachusetts Avenue
Alternative: Relocated

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Boston Proper	264	233	20	0	517	1550	1600
Dorchester	0	121	20	0	141	420	410
Parker H/Fen	53	14	0	0	67	200	205
Roxbury	74	205	15	0	294	880	845
South Boston	0	185	15	0	200	600	570
Total	391	758	70	0	1219	3650	3630

Station Name: Back Bay
Alternative: Relocated

City or Town of Origin	7-10 AM Inbound Boardings Walk	Transfer*	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Boston Proper	540	705	0	0	1245	8715	9150
Total	540	705	0	0	1245	8715	9150

*Transfer from Penn Central Commuter Rail

Station Name: South Cove
Alternative: Relocated

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Boston Proper	766	151	0	0	917	4585	4725
Total	766	151	0	0	917	4585	4725

(FIG. IV-12)

ESTIMATED INBOUND BOARDINGS AND LINE VOLUMES - "SHAWMUT AVENUE SUBWAY", SOUTHWEST CORRIDOR (UNCONSTRAINED BY PARKING CAPACITIES) 1/5/1976

Station	1980 Peak Period Boardings	Offs	Line Vols	1980 24-Hour Boardings	Offs	Line Vols	1995 24-Hour Boardings	Offs	Line Vols
Forest Hills	8501	0	8501	14450	0	14450	15600	0	15600
Green Street	840	15	9326	2020	40	16430	1980	40	17540
Egleston	1797	81	11042	3865	220	20075	3765	210	21095
Dudley	3910	515	14437	8620	1070	27625	8310	1035	28370
Northampton	1246	600	15083	3540	1710	29455	3485	1690	30165
Berkeley	742	1150	14675	3710	2260	30905	3820	2330	31655
South Cove	917	1397		4585	2795		4725	2880	
Total	17953	3758	14195	40790	8095	32695	41685	8185	33500

(FIG. IV-13)

ESTIMATED UNCONSTRAINED STATION BOARDINGS BY ACCESS MODE AND ZONES OF ORIGIN - "SHAWMUT AVE SUBWAY" SYSTEM, SOUTHWEST CORRIDOR 1/5/76

Station Name: Forest Hills
Alternative: Shawmut Avenue Subway

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Brookline	0	88	92	22	202	303	316
Canton	0	0	0	57	57	69	88
Dedham	0	344	43	360	747	971	1049
Dorchester	0	243	24	42	309	523	512
Dover	0	0	0	90	90	108	129
Foxborough	0	0	0	69	69	76	85
Hyde Park	0	980	74	147	1201	2161	2330
Jamaica Plain	685	405	22	20	1132	2300	2256
Medfield	0	0	0	80	80	97	120
Millis	0	0	0	14	14	17	22
Milton	0	0	0	65	65	85	90
Needham	0	0	0	144	144	187	204
Newton	0	0	3	18	21	27	28
Norwood	0	145	10	227	382	497	557
Randolph	0	0	0	15	15	18	25
Roslindale	88	1743	83	63	1977	3756	4132
Roxbury	2	11	0	0	13	21	20
Sharon	0	0	0	17	17	20	22
Sherborn	0	0	0	17	17	20	32
Walpole	0	0	0	79	79	95	121
West Roxbury	0	1155	79	110	1344	2419	2613
Westwood	0	264	11	206	481	625	782
Other	0	0	9	36	45	55	67
Total	775	5378	450	1898	8501	14450	15600

Station Name: Green Street
Alternative: Shawmut Avenue Subway

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Jamaica Plain	736	75	11	18	840	2020	1980
Total	736	75	11	18	840	2020	1980

Station Name: Egleston
Alternative: Shawmut Avenue Subway

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Dorchester	0	408	70	0	478	1030	1010
Jamaica Plain	536	92	0	0	628	1350	1325
Roxbury	555	130	6	0	691	1485	1430
Total	1091	630	76	0	1797	3865	3765

(FIG IV- 13)(Continued)

ESTIMATED UNCONSTRAINED STATION BOARDINGS BY ACCESS MODE AND ZONES OF ORIGIN - "SHAWMUT AVE SUBWAY" SYSTEM, SOUTHWEST CORRIDOR 1/5/76

Station Name: Dudley
Alternative: Shawmut Avenue Subway

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Dorchester	0	435	0	0	435	953	934
Jamaica Plain	52	0	0	0	52	115	113
Parker H/Fen	0	118	0	0	118	272	275
Roxbury	885	2319	101	0	3305	7280	6988
Total	937	2872	101	0	3910	8620	8310

Station Name: Northampton
Alternative: Shawmut Avenue Subway

City of Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Boston Proper	457	3	0	0	460	1312	1352
Dorchester	0	40	0	0	40	95	93
Parker H/Fen	0	17	0	0	17	49	50
Roxbury	333	21	0	0	354	1016	975
South Boston	50	325	0	0	375	1068	1015
Total	840	406	0	0	1246	3540	3485

Station Name: Berkeley
Alternative: Shawmut Avenue Subway

City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Boston Proper	742	0	0	0	742	3710	3820
Total	742	0	0	0	742	3710	3820

Station Name: South Cove
Alternative: Shawmut Avenue Subway

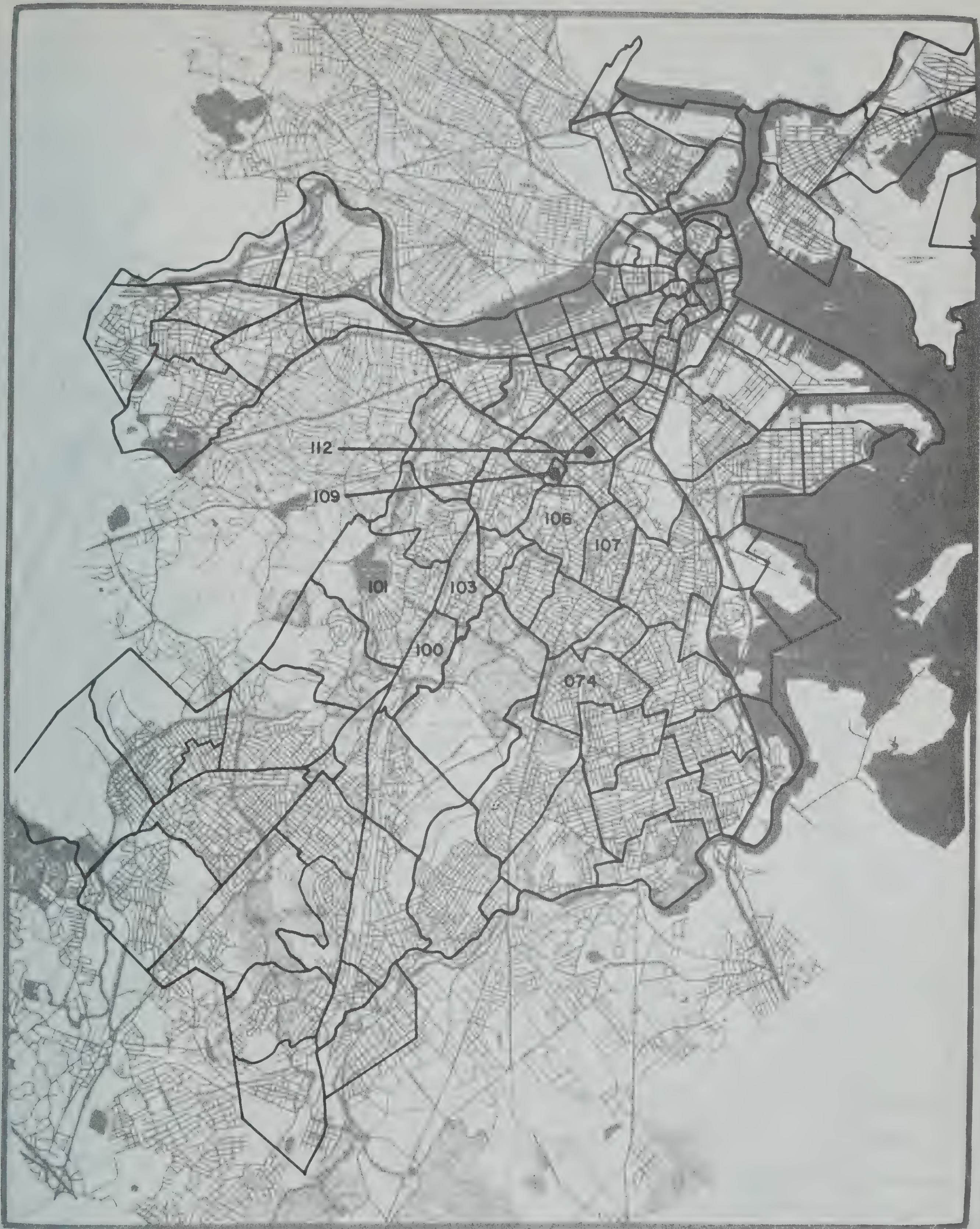
City or Town of Origin	7-10 AM Inbound Boardings Walk	Bus	Kiss	Park	1980 Peak Total	1980 24 Hr. Total	1995 24 Hr. Total
Boston Proper	766	151	0	0	917	4585	4725
Total	766	151	0	0	917	4585	4725

(FIG. IV-15)

COMPARISON OF ALTERNATIVES

	Estim. 1980 North-bound Dialy Riders	Estim. 1980 increased revenue*	Estim. yearly user benefit*	Estimated yearly operating cost saving* (in 1974 dollars)
No build	33,320	-	-	-
Penn Central Alignment	55,565	$3.2 mill.	$4.8 mill.	$1.3 million
Shawmut/Washington Alignment	40,790	$1.1 mill.	$3.4 mill.	$2.0 million

*As compared with no build



TRAFFIC ZONES WITHIN THE CITY OF BOSTON

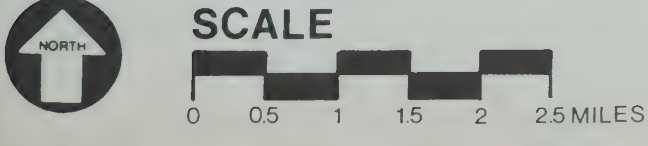


FIGURE IV-16

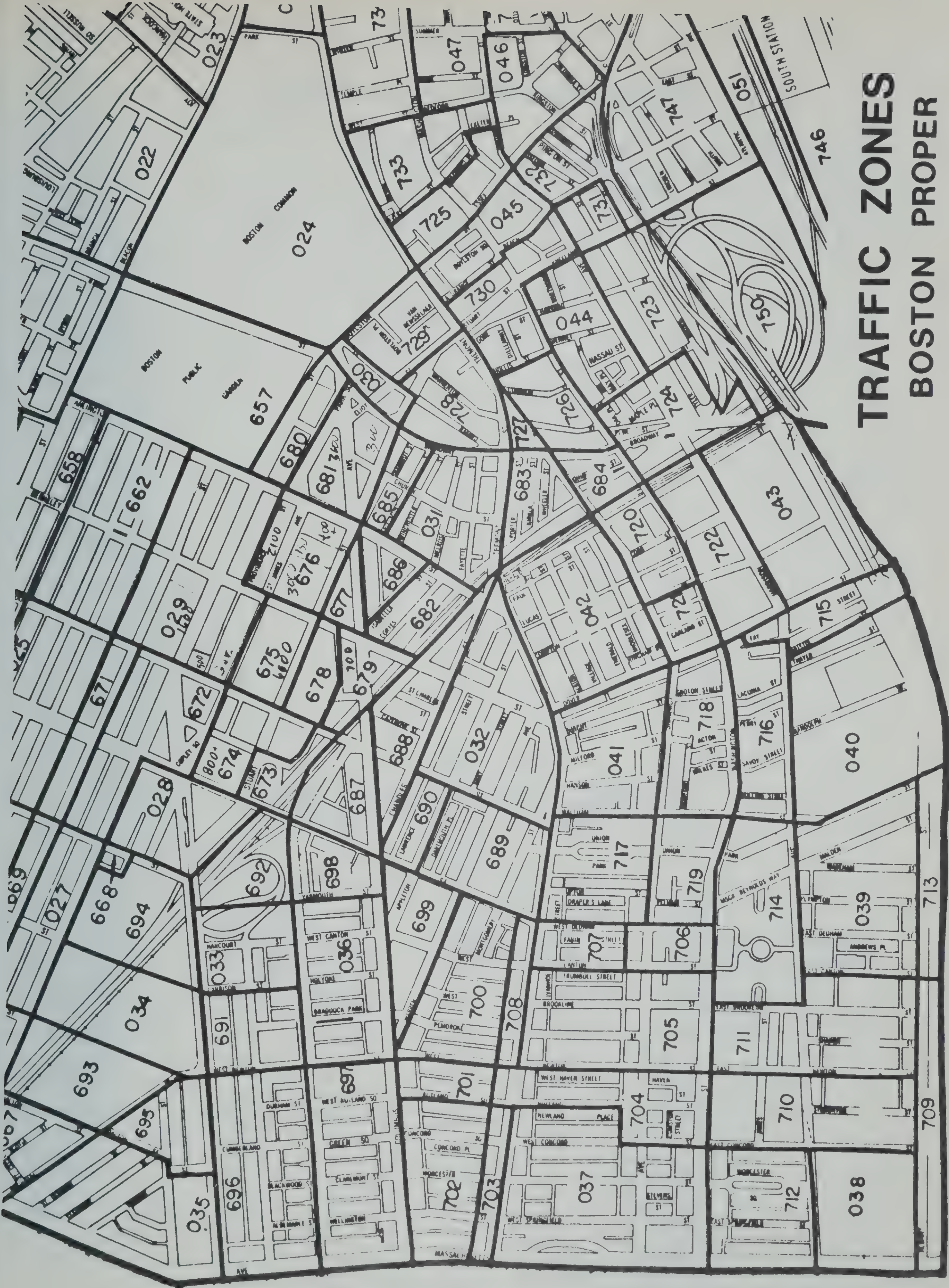


FIGURE IV-16A

(FIG. IV - 17)

PRESENT 8 AM - 9 AM ARRIVAL SCHEDULE

Origin	Train #	Arr. into Back Bay AM	Headway if Operated over A Single Track	Double-track Headway Trk A	Double-track Headway Trk B
Needham	734	8:03			
			2 min.		
Providence	502	8:05			
			3 min.	5	
Franklin	712	8:08			6
			3 min.		
Stoughton	802	8:11		12	
			9 min.		
Amtrak	66	8:20			15
			6 min.		
Needham	736	8:26		10	
			4 min.		
Franklin	714	8:30			13
			9 min.		
Providence	504	8:39			
			7 min.	16	
Needham	738	8:46			14
			7 min.		
Stoughton	804	8:53			

(FIG. IV-18)

TRAIN LENGTH AND AVERAGE HEADWAYS IN MINUTES FOR DEMAND PROJECTED TO 1980

Line	1980 30% increase in demand: Peak Hour Train Length and Average Headway	1980 40% increase in demand: Peak Hour Train Length and Average Headway	1974 Consists arriving 8 a.m. to 9 a.m.
Needham	5,5,5,5 (15 min.)	5,5,5,6 (15 min.)	6,6,3 (20 min.)
Franklin	5,5,2 (20 min.)	5,5,3 (20 min.)	8,2 (30 min.)
Stoughton	5,5 (30 min.)	5,6 (30 min.)	6,2 (30 min.)
Providence	5,5,5,5 (15 min.)	5,5,6,6 (15 min.)	10,5 (30 min.)
Total # of CRR Trains	13	13	9
AMTRAK TRAINS	4	4	1
TOTAL	17	17	10

(FIG. IV-19)

COMBINED ALTERNATIVES	ALTERNATIVE BOUNDARIES & DESIGNATION	
	South Cove to Camden Street	Camden Street to Forest Hills
NO BUILD RAIL/TRANSIT, NO BUILD ARTERIAL STREET	NB-1	NB-1
DEPRESSED RAIL/TRANSIT, NO ARTERIAL STREET	-	FH-1
- with minimum grade adjustments, all tracks	SC-1	-
- with Orange Line in tunnel to Dartmouth Street	SC-2	-
- with Forest Hills Station elevated (option)	-	FH-1a
DEPRESSED RAIL/TRANSIT, ARTERIAL STREET EAST	-	FH-2
- with minimum grade adjustments, all tracks	SC-1	-
- with Orange Line in tunnel to Dartmouth Street	SC-2	-
- with Forest Hills Station elevated (option)	-	FH-2a
- with Arterial to Jackson Square only (2 options)	-	FH-2b, 2c
RAIL/TRANSIT ON MODIFIED EMBANKMENT, NO ARTERIAL STREET	-	FH-3
- with minimum grade adjustments for all tracks	SC-1	-
- with Orange Line in tunnel to Dartmouth Street	SC-2	-
RAIL TRANSIT ON MODIFIED EMBANKMENT, ARTERIAL CROSSING EAST TO WEST	-	FH-4
- with minimum grade adjustments, all tracks	SC-1	-
- with Orange Line in tunnel to Dartmouth Street	SC-2	-
- with Arterial to Jackson Square only (2 options)	-	FH-4a, 4b
MODIFIED-DEPRESSED RAIL/TRANSIT, ARTERIAL STREET EAST	-	FH-5
- with minimum grade adjustments, all tracks	SC-1	-
- with Orange Line in tunnel to Dartmouth Street	SC-2	-
MODIFIED-DEPRESSED RAIL/TRANSIT, NO ARTERIAL OF JACKSON SQUARE	-	FH-6, 6a
- with minimum grade adjustments, all tracks	SC-1	-
- with Orange Line in tunnel to Dartmouth Street	SC-2	-
POST HEARING PROFILE RAIL/TRANSIT, NO ARTERIAL SOUTH OF JACKSON SQUARE	PHP-1	
POST HEARING PROFILE RAIL/TRANSIT, ARTERIAL STREET EAST	PHP-2	

(FIG. IV - 19A)

CROSS REFERENCES FOR FIGURES IV-20 THROUGH IV-96 LISTED IN SECTION 4.0

FIGURE NUMBERS MENTIONED IN SECTION 4.0, VOLUME I						REFER TO THESE PLAN/ PROFILE DRAWINGS	
FH-1	FH-2	FH-3	FH-4	FH-5	FH-6	PHP-1	PHP-2
IV-20	IV-27	IV-34	IV-41	IV-49	IV-56	IV-56	IV-49
IV-21	IV-28	IV-35	IV-42	IV-50	IV-57	IV-57	IV-50
IV-22	IV-29	IV-36	IV-43	IV-51	IV-58	IV-58	IV-51
IV-23	IV-30	IV-37	IV-49	IV-52	IV-59	IV-59	IV-52
IV-24	IV-31 &31A	IV-38	IV-45 &45A	IV-53	IV-60	IV-60	IV-53
IV-25	IV-32	IV-39	IV-46	IV-54		IV-54	IV-54
IV-26	IV-33	IV-40	IV-47	IV-55		IV-55	IV-55

SC-1	SC-2	PHP-1	PHP-2
IV-63	IV-66	IV-63	IV-63
IV-64	IV-67	IV-64	IV-64
IV-65	IV-68	IV-65	IV-65

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

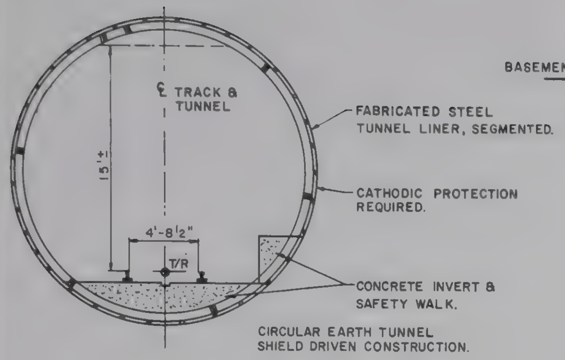
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

CONSTRUCTION DETAILS

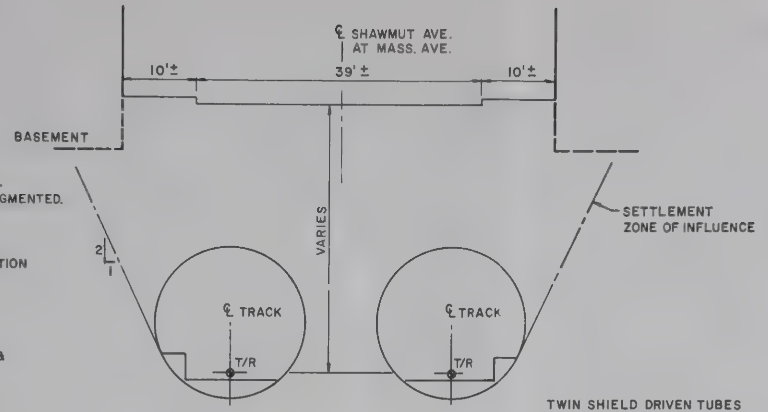
WASHINGTON / SHAWMUT ALIGNMENT

NO SCALE

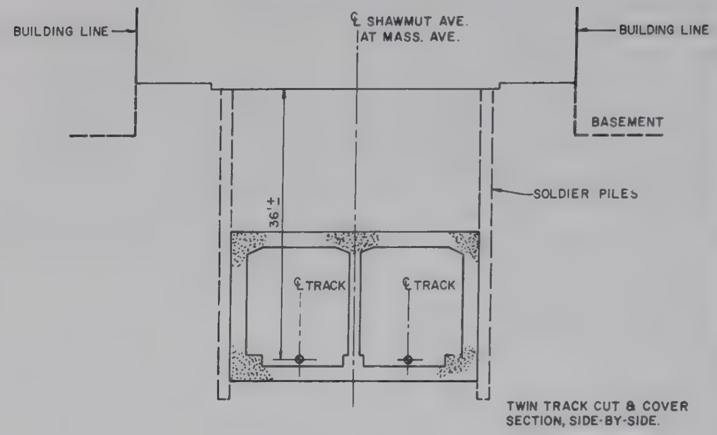
FIGURE IV-99



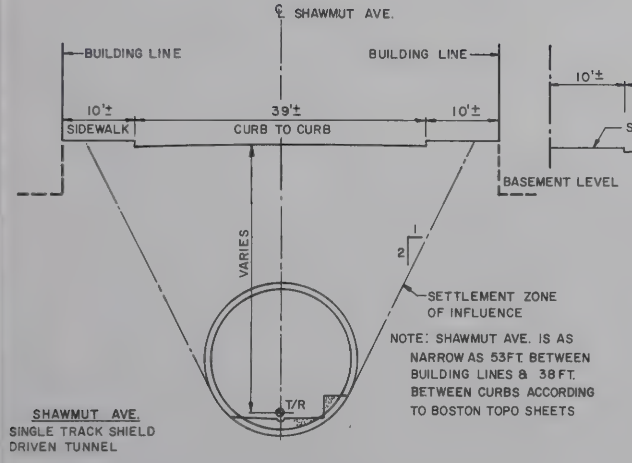
DETAIL A



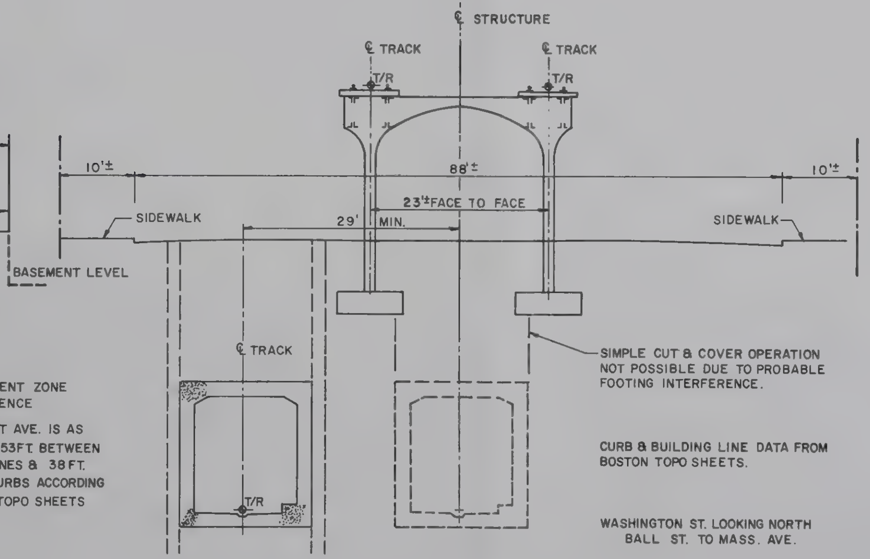
DETAIL B



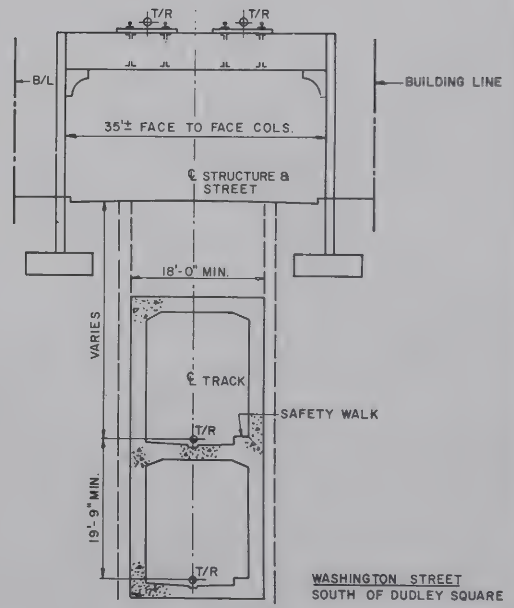
DETAIL C



DETAIL D

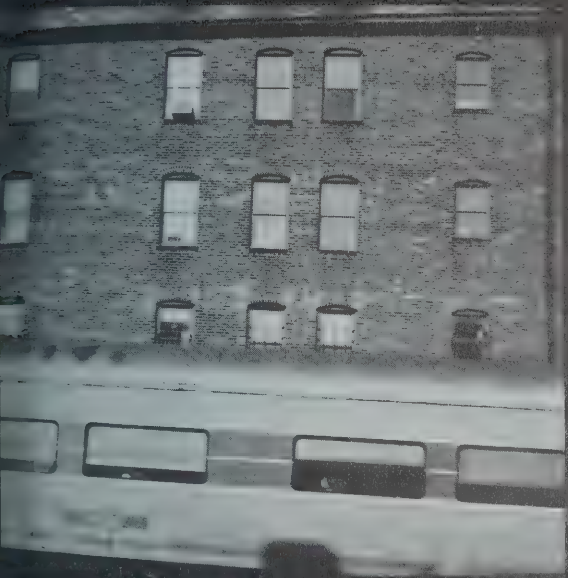


DETAIL E



DETAIL F

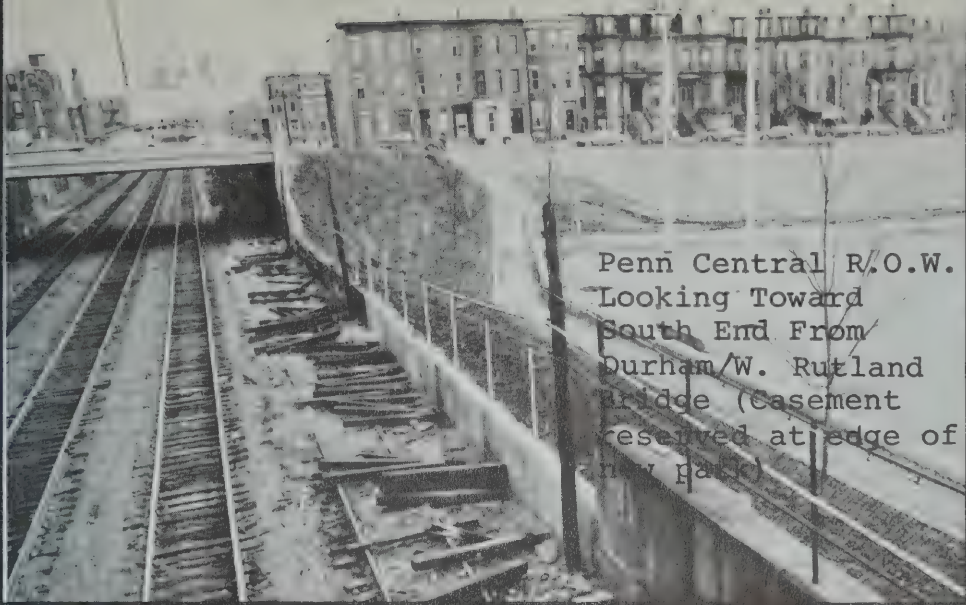
Penn Central R.O.W. Looking Toward
Mass. Ave. Bridge, South End



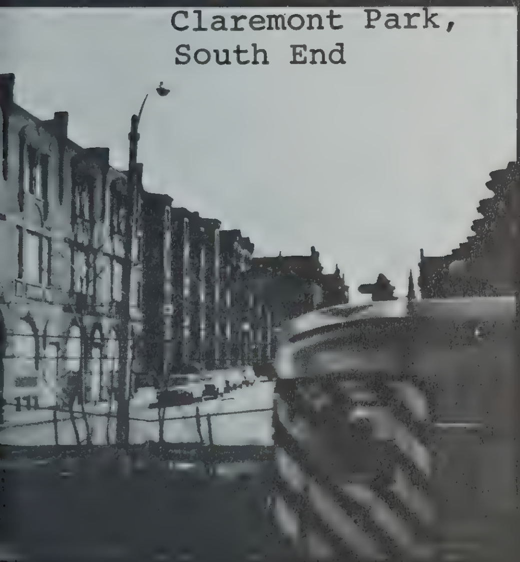
ckwood Street Structures (above)
. Botolph Neighborhood From The
uth End (below)

FIG. IV-100

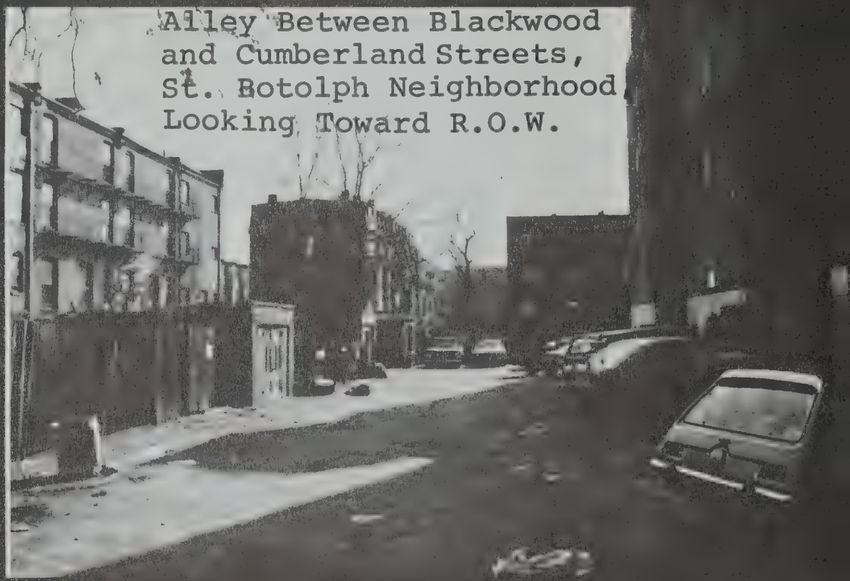
Looking Toward Blackwood Street,
St. Botolph Neighborhood



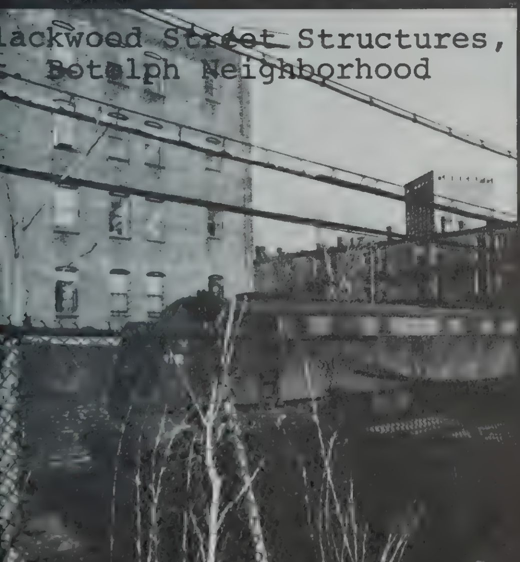
Penn Central R.O.W.
Looking Toward
South End From
Durham/W. Rutland
Bridge (Casement
reserved at edge of
new park)



Claremont Park,
South End



Alley Between Blackwood
and Cumberland Streets,
St. Botolph Neighborhood
Looking Toward R.O.W.



lackwood Street Structures,
. Botolph Neighborhood

Alley Between Cumberland And Durham
Streets From South End

FIG. IV-101

CHAPTER FIVE:
PROBABLE IMPACTS OF PROJECT ALTERNATIVES

5.0 PROBABLE IMPACTS OF PROJECT ALTERNATIVES

In analyzing the impact of this project certain definitions should be remembered:

- "Impact" is considered to be any change to existing or future surroundings which would not have occurred if the project were not built. Under this definition the No-Build Alternative may be said to have a neutral impact; that is, present area trends and conditions will follow their natural courses. For this reason, the No-Build Alternative is used as a basis of comparison for the effects of the other alternatives.

- This report attempts to cover the beneficial as well as the negative impacts expected from the project. Where the two are due to the same action, both are covered under their respective headings.

- Impacts, as shown for each alternative, are the final result after all practical measures have been taken to minimize them.

5.1 Transportation Impacts

5.1.1 Rapid/Transit Ridership

Patronage estimates were prepared by the Central Transportation Planning Staff for the forecast years 1980 and 1995 for the relocated Orange Line from Forest Hills to Back Bay Station. For the purposes of these forecasts it was assumed that an arterial street would be built concurrently between Forest Hills and Ruggles Street since this would produce the most conservative estimate of transit ridership. A conventional computerized transportation planning modelling process calibrated to the Eastern Massachusetts Region has been used to produce ridership estimates for a No-Build alternative and for the relocated alternatives. The ridership estimates developed in this section relate to the several alternatives on the railroad right-of-way. The ridership estimates would be the same for all Relocated alternatives with the same location alignment even though the rail elevation would change depending on the alternative. This stability in ridership would occur because the number of station locations would remain unchanged.

Rapid/Transit Demand and Ridership

Using the results of the ridership demand modelling process, the total daily demand for rapid/transit boardings at the seven planned stations between Forest Hills and Massachusetts Avenue has been estimated to be 42,700 boardings in 1980 and 43,300 boardings in 1995. By including Back Bay and South Cove stations, the estimated inbound daily boardings in 1980 would be over 56,000 and more than 57,100 in 1995. These ridership demands are unconstrained by parking capacities at the stations. When parking constraints are applied at the Forest Hills station there is a reduction in ridership of 1236 boardings per day in 1980.

In the No-Build alternative, the total daily demand for rapid-transit boardings on the existing Orange Line has been estimated to be 33,300 boardings in 1980 and 34,000 boardings in 1995. These estimates are also unconstrained by parking capacities at these stations. This means that there would be a net increase in ridership of 9,400 in 1980 and 9,300 in 1995 between the No-Build and the Relocated Orange Line alternatives for the seven stations on each line (those compared for the relocated Orange Line are south of Massachusetts Avenue). By including Back Bay and South Cove stations the increases on the Relocated alignment would be 22,700 in 1980 and 23,200 in 1995.

These demand-ridership figures include intracorridor ("local") trips as well as "through" trips to Boston proper. However, the vast majority of the transit riders are making through trips rather than local ones.

Distribution of Ridership Among Stations

The ridership increases from 33,300 (1980) for the five stations in the No-Build alternative to 43,300 (1995) for the seven stations in the Relocated alternative. The majority of these new riders are picked up by the new stations at Boylston Street, Jackson Square and Ruggles Street. The ridership at the Forest Hills and the Green Street Stations increases only slightly. Thus, in 1995, there would be a net increase of 10,000 riders from the No-Build (1980) to the Relocated alternative (1995) at the stations south of Massachusetts Avenue and an increase of 23,000 riders when the Back Bay and South Cove stations are included.

Origins of Transit Ridership

There is a substantial difference in the ridership characteristics between the No-Build and Relocated alternatives. The Roxbury, Parker Hill/Fenway, and Jamaica Plain areas show substantial increases in ridership (see Fig. V-1) because the relocated Orange Line would be more centrally located with respect to densely developed areas of these same communities than the existing location. Smaller increases are shown for Roslindale, West Roxbury and Hyde Park. Increases in ridership between the No-Build and Relocated alternatives are negligible in most of the other communities in the Southwest Corridor. A town-by-town comparison of 24-hour boardings (1980) at each station for the two alternatives appears in Fig. V-1. The estimated boardings at each station for the two alternatives appears in Fig. V-2.

Mode of Station Access

A comparison of the 1980 No-Build and Relocated alternatives indicates an increase of about 2,600 transit riders during the 7 to 10 AM peak period for the stations between Forest Hills and Massachusetts Avenue and nearly 4,800 transit riders when Back Bay and South Cove stations are included. Minor differences are indicated in the kiss-and-ride and park-and-ride access modes. The most significant difference would occur in the feeder bus system where an increase of nearly 2,700 passengers would be expected during the 7 to 10 AM peak period. When the Back Bay and South Cove stations are included, over 3,500 passengers would be expected to be served by feeder bus and by railroad transfers at Back Bay station.

At other hours of the day, substantial increases in the "walk" category would be expected because of the close proximity between major transit generators such as the Back Bay commercial district, Northeastern University, Mission Hill, Whittier Street and Bromley/Heath Housing Projects, Campus High School, the proposed Roxbury Community College, the proposed Jamaica Plain II High School, and other potential development in the immediate vicinity of the proposed new transit stations.

The Forest Hills station is the only station to have a large number of park-riders in all alternatives. These park-riders come from all parts of the Southwest Corridor. It may be noted that most of the park-riders using the Forest Hills station come from communities which are farther removed from the station than either kiss-riders or transit users going across to the Forest Hills Station by bus.

5.1.2 Effects of Potential Future Rapid/Transit Extensions on Orange Line Ridership

Regional transportation plans have considered two possible extensions of the Orange Line beyond Forest Hills to Route 128 via the Needham Branch right-of-way; and to Hyde Park and Canton via the Penn Central main line and the Canton Branch right-of-way. If either or both of these extensions were to be placed into operation, a sizeable number of transit users would divert to stations on these extensions from the Forest Hills Station.

There would be a reduction of park-riders at the Forest Hills station if the Orange Line is to be extended from Forest Hills to either Route 128 on the Needham or Canton branch. It has been estimated that in 1980 approximately 400 park-riders would be diverted from Forest Hills to stations along the extension. By 1995, 350 park-riders would be diverted to these stations. Similarly, approximately 3,900 transit users would be diverted from Forest Hills to stations along the Orange Line extension which would include Forest Hills to Route 128 via the Needham Branch. It must be emphasized that these are merely transit diversions. They do not include diversions from other modes such as automobiles and commuter rail. They do not include new transit trips encouraged by a higher level of service. If both extensions are placed into operation, an even greater number of transit users would be diverted.

Thus, the impact of rapid transit extensions to either Canton or Route 128 at Needham would affect the number of boardings at only the Forest Hills station on the proposed Relocated Orange Line.

5.1.3 Computer Rail and Amtrak Ridership

Commuter-rail ridership and Amtrak ridership are important factors in developing alternatives in the Southwest Corridor. Demand for rail ridership will determine the number of trains per hour to be operated on the main line of the Penn Central. The number of trains will in turn determine the number of tracks needed by commuter rail and Amtrak trains in order to operate at the necessary level of service to meet anticipated ridership demand.

According to the 1974 MBTA Audit which is a headcount of all suburban commuter-rail passengers, a total of 4418 passengers are carried in the inbound direction each day. The breakdown is as follows:

- Providence Main Line - 1787 passengers
- Needham Branch - 1367 passengers
- Franklin Branch - 1015 passengers
- Stoughton Branch - 249 passengers

Ridership on these commuter lines, projected to 1980, based on a moderate increase of service described in Appendix C is as follows:

- Providence Main Line - 2200 passengers
- Needham Branch - 1900 passengers
- Franklin Branch - 1500 passengers
- Stoughton Branch - 700 passengers

Therefore, a total of 6,300 passengers would be riding the commuter-rail system on a daily basis in 1980 in the inbound direction.

Current Amtrak ridership figures indicate a daily ridership of 3391 passengers at the New Haven checkpoint (May 27-June2, 1975). Future ridership is estimated by the Federal Railroad Administration to be approximately 22,400 high-speed inter-city rail passengers arriving or departing from South Station in their design year, it is estimated that the peak-hour one-way ridership at South Station will be approximately 1,700 passengers (arriving or departing). These ridership forecasts are based on trains arriving or departing from South Station in Boston at fifteen-minute intervals during the peak hours of operation.

5.1.4 Feeder-Bus Systems

As a result of the proposed Orange Line relocation west of the present elevated Orange Line, a number of changes must be made to the present MBTA feeder-bus system. Ridership estimates for this revised feeder-bus network have been made for each station on the Relocated Orange Line.

The number of rapid-transit patrons who arrive at stations by bus on the Relocated Orange Line is expected to increase from the base year No-Build alternative forecasts. Approximately 9,500 additional rapid-transit patrons would arrive at rapid-transit stations by bus in the Relocated alternative on a daily basis in 1980. These ridership forecasts assume no new MBTA bus service in place of the existing bus service. However, a number of bus routes would be rerouted or consolidated to serve the new stations on the Relocated Orange Line.

A breakdown of the number of bus riders gaining access to the Relocated Orange Line rapid-transit stations on a daily basis is as follows:

- Forest Hills - 9,070
- Green Street - 270
- Boylston Street - 0
- Jackson Square - 5,250
- Roxbury Crossing - 4,100
- Ruggles Street - 5,900
- Massachusetts Avenue - 2,300

The number of persons who would arrive at the boarding transit station by bus would increase from 5,400 to 7,000 in the peak hour and from 18,500 to 26,500 on a daily basis between the No Build and the Relocated alternatives (from Massachusetts Avenue to Forest Hills). This increase in bus ridership would mean an increase in the number of buses required to serve this demand.

The feeder bus routes proposed to serve the Relocated Orange Line are shown on Fig. V-4. This proposed route diagram shows the changes that would be required in the existing routes to serve the Relocated Orange Line stations. On the basis of these proposed routes and schedules, the Forest Hills, Ruggles and Jackson Square Stations would be the most important bus-transfer locations. No significant routing changes would be needed to serve Forest Hills station. The major routing changes would relate to providing bus service to Jackson Square and Ruggles Street stations in lieu of servicing Egleston and Dudley Street stations. Within the Roxbury area, the proposed arterial street would be one of the most important feeder streets. Other important bus-circulation streets would include sections of Washington Street and New Dudley Street. The existing and proposed route pattern disperses the bus loading to many streets, thereby avoiding high concentrations of buses except in the immediate vicinity of the proposed stations. In addition, some passengers will transfer from the Green Line to the Orange Line at Forest Hills.

5.1.5 Local Traffic Generated by Transit-Related Development

While there would be efficiencies gained on bus routes that traverse new arterial streets, there would be some local traffic generated by the development of the Relocated Orange Line stations. This traffic would be generated by "new" transit riders who reach the transit stations by automobile or bus. The

concentrations of this traffic would be diverted from existing high-density areas at Northampton, Dudley Station and Egleston Square and shifted to new areas in the cleared-land corridor at Ruggles Street and Jackson Square.

Since the demand for parking around transit stations is constrained by parking capacities in the Relocated alternatives as well as the No-Build alternative, there would not be an increase in the number of park-riders. Thus, there would not be an increase in the number of automobiles on the streets in the vicinity of the transit stations due to the park riders. However, there would be an increase in the number of transit riders who get dropped off at transit stations by auto or taxi. Approximately 900 more passengers would be dropped off at the transit stations between Forest Hills and Massachusetts Avenue on a daily basis between the No-Build and the Relocated alternatives. However, this translates to an increase of about 45 automobiles in the peak hour around these same transit stations. Therefore, there would not be an appreciable increase in the number of automobiles gaining access to the transit station on the Relocated Orange Line.

There would be some commercial development in the vicinity of several of the stations.

At the smaller stations, such as Green Street and Boylston Street, the commercial development would be relatively small and would be oriented primarily toward transit passengers. Accordingly, the amount of traffic that would be generated by this type of development would be minimal.

At the larger stations, the commercial development would attract traffic in addition to the transit riders. The magnitude of this traffic generation would be comparatively small in relation to the traffic generation of the surrounding area. In developing the traffic projections for the Southwest Corridor, new development was allocated to appropriate traffic zones. Therefore, traffic projections that were developed for the area included the proposed developments on an area basis rather than developing traffic projections for each parcel. At the stations where significant commercial development is proposed, such as Forest Hills and Ruggles Street, off-street parking is proposed as part of the development program.

5.1.6 Arterial Street Impacts

To assess the impacts of traffic volume on the streets affected by the proposed alternatives, traffic projections were made by the Central Transportation Planning Staff for three basic networks for the years 1980 and 2000. The networks for which assignments were prepared include the following:

a) The existing street network which also represents the "No Build" alternative.

b) The existing street network modified to include an arterial street to be constructed from Massachusetts Avenue at the Southeast Expressway ramps to Jackson Square. This alternative will be identified as "Arterial to Jackson Square".

c) The existing street network modified to include the same arterial street shown in (b) but extended from Jackson Square to Forest Hills. This alternative will be identified as "Arterial to Forest Hills".

The basic network was developed for traffic projection purposes to reflect the arterial street completed to Forest Hills. It does not differentiate between the various options discussed in other sections of this report. These options would involve the detailed location of the proposed arterial street as to whether it is to be east or west of the railroad or whether the railroad would be elevated or depressed. Since these options would all provide the same vehicular transportation service or would have the same or similar side-street

connections, there would be no significant traffic assignment differences between the several options. Accordingly, the traffic assignments presented will only distinguish between the three basic alternatives and the two target years of 1980 and 2000.

The design year 1980 traffic assignments for each of the three basic networks, "No Build", "Arterial to Jackson Square", and "Arterial to Forest Hills", are presented in Figs. V-6, V-7 and V-8, respectively. The corresponding traffic assignments for the year 2000 are shown on Figs. V-9, V-10 and V-11.

Traffic Growth

A comparison of the traffic-flow diagrams for the "No Build" alternative shown on Fig. III-11 (existing traffic volumes - 1975), Fig. V-6 (projected daily traffic volumes - 1980) and Fig. V-9 (projected daily traffic volumes - 2000) indicates no significant change in anticipated traffic volumes between 1975 and 1980. Between 1980 and 2000, a growth of approximately 10 percent is expected in the Southwest Corridor. This level of traffic growth is based on projected population and employment changes between 1980 and 2000 throughout the metropolitan area of Boston. In the Southwest-Corridor study area particular attention was given to future development being planned for the area and changes in the modal split of person-trips in the Corridor.

In a very real sense, the answer to the amount of traffic growth on the arterial street system of the Southwest Corridor is a function of one's definition of the geographic extent of the Southwest Corridor. For purposes of all highway traffic analysis, the inner portion (Forest Hills to Jackson Square and onto Massachusetts Avenue) of the Corridor has been considered to be an area approximately 10,000 feet east to west centered on the existing Penn Central Railroad Main Line right-of-way. With this as the definition of the area of interest, the outer boundries in the Jamaica Plain area (Segment #3 of the proposed arterial street) become Blue Hill Avenue to the east and the Jamaicaway to the west. Using the above definition as that of the full Southwest Corridor, a comparison of daily traffic usage as summarized in Figs. V-10 and V-11 on radial north-south routings (to/from Downtown Boston) shows a very modest increase between the construction of the arterial only to a Jackson Square terminus and its construction to a Forest Hills terminus. A screenline (an imaginary line bisecting the Corridor along which the traffic on all intersected streets is summed to produce a grant total) drawn at the southern end (just north of Forest Hills) shows an increase of approximately 8 percent. A similar screenline just south of Jackson Square shows an increase of slightly less than 5 percent. As one moves further north, above Jackson Square, the difference reduces to less than 3 percent. It is this 3 to 8 percent growth in traffic movement that is anticipated at the corridor level.

Notwithstanding the above corridor level analysis, it is equally true that for a much narrower band, perhaps 500 to 1000 feet on each side of the rail right-of-way, there is a greater increase in traffic as the arterial street performs the function of consolidating traffic otherwise serviced by several routings into one main routing. The percentage of growth in traffic at the three previously defined screelines for this very localized bandwidth would be 91 percent north of Forest Hills, reducing to 36 percent and 17 percent as one moves further north (toward Downtown Boston). This greater to lesser growth shows the impact of the proposed Segment #3 of the arterial street in its traffic management function compared to construction of only Segments #1 and #2q

Comparison of Alternatives - "No Build" vs. "Arterial Built to Jackson Square" (1980)

The traffic projected for the 1980 No Build alternative would exhibit the same characteristics as the existing street system. There would be no substantial change in the patterns of travel or in the volume of traffic on most of the streets in the study area.

Where comparison is made of the construction of the arterial street to Jackson Square in relation to the No Build alternative the most significant traffic impacts would occur in the northerly end of the study area. The construction would create a new street with significant improvement in alignment and grade. This improvement would attract some vehicular traffic on the arterial street which now uses other streets. An example of this traffic diversion can be seen by comparing the volumes projected on the group of streets crossing Massachusetts Avenue between Huntington Avenue and the Southeast Expressway. A Study of the total of all traffic in this Corridor indicates there would be about 4,000 motorists (a 3.08 percent increase) induced into the Corridor on a daily basis if the arterial is built to Jackson Square compared to a 1980 No Build alternative. The distribution of traffic on these streets would shift as a direct result of arterial street construction. The following tabulation compares the projected volumes of traffic on these streets.

1980 Projected Daily Traffic Volumes [1]

(in thousands)

	No-Build	Arterial to Jackson Sq.
Huntington Avenue	22.0	22.5
Columbus Avenue	15.0	11.0
Tremont Street	18.0	16.0
Shawmut Avenue	3.0	3.0
Washington Street	13.0	11.5
Harrison Avenue	8.0	9.0
Albany Street	13.0	17.5
Southeast Expressway Ramps	38.0	43.5
	130.0	134.0

[1]Screen line at Massachusetts Avenue

The proposed realignment of Columbus Avenue, at the intersection with the arterial, would serve to reduce the volume on Columbus Avenue and encourage motorists to follow the new arterial toward Massachusetts Avenue. This diversion explains the indicated increase in traffic projected for the Southeast Expressway ramps and Albany Street.

This traffic inducement would also be reflected on the main-line segment of the arterial street. In the No Build alternative, the segment of Columbus Avenue (north of Jackson Square) is projected to carry approximately 39,000 vehicles daily. With the arterial built to Jackson Square, the equivalent section would be expected to carry 42,500 vehicles daily in 1980. This increased amount of traffic would flow to the arterial on the existing feeder streets including Centre Street, Lamartine Street, Amory Street, and Columbus Avenue. Lamartine Street would be expected to receive the largest portion of this traffic impact or about 1,500 vehicles daily.

No Build vs. Arterial Built to Forest Hills (1980)

Construction of the arterial street from Massachusetts Avenue to Forest Hills would be expected to include an additional increment of traffic into the Corridor in comparison to either the No Build or arterial built to Jackson Square alternatives. At the Forest Hills end of the project, the induced Corridor volume would be expected to be about 8,500 vehicles daily. At the Massachusetts Avenue end of the project, the induced Corridor volume would be expected to be about 10,500 vehicles daily.

In Forest Hills, this daily traffic inducement would be reflected primarily on Washington Street (4,000 vehicles) Hyde Park Avenue (3,500 vehicles), and South Street (1,000 vehicles). At the Massachusetts Avenue end of the project, the most significant impact would be on the Southeast Expressway ramps with an anticipated increase of about 9,500 vehicles daily. Some additional

changes would be expected in the distribution of the traffic on the other streets crossing Massachusetts Avenue. Traffic volumes on Huntington Avenue and Albany Street would be expected to increase while traffic volumes on Columbus Avenue, Tremont Street and Washington Street would be expected to decrease. Traffic volumes on Shawmut Avenue and Harrison Avenue would likely remain relatively stable.

A detailed comparison of the projected 1980 traffic volumes on the no-build and arterial built to Forest Hills alternatives shows comparatively small changes on a number of streets generally perpendicular to the proposed arterial. In most cases the projected volume on a street perpendicular to the arterial increases under the arterial built to Forest Hills alternative. This shift in the basic travel pattern occurs because the arterial street would attract many motorists from the nearby areas who presently use other parallel routes. This shifting of local travel patterns would mean that through traffic on the north-south streets would be substantially reduced. The reduction in traffic would be partially off-set by local motorists who would change their travel pattern to get direct access to the new arterial.

If the arterial street were completed between Forest Hills and Massachusetts Avenue, anticipated daily volumes on the arterial would range between 29,000 vehicles daily at Forest Hills and 49,000 at Jackson Square. The section between Forest Hills and Jackson Square could expect daily volumes ranging between 29,000 and 36,000. Daily volumes in the section between Jackson Square and Ruggles Street would range between 49,000 in Jackson Square and 37,000 vehicles daily at Ruggles Street.

Probably the most significant impact of constructing an arterial street to Forest Hills would be the reduction of traffic on streets like Amory, Lamartine, Call,and Forest Hills. Only local residents or vehicles servicing there would use Amory and Lamartine Streets. Through traffic would use the arterial street. To assure traffic relief on Amory Street, the southern terminus at Green Street would be relocated to join Brookside Avenue a short distance north of Green Street. The connection between Amory Street and Columbus Avenue, in Jackson Square, would also be relocated away from the Jackson Square intersection. This would allow local traffic and emergency vehicles easy access to the street while it would discourage "through traffic" on Amory Street.

Action would also be taken to assure traffic relief on Lamartine Street. It is proposed that the continuity of Lamartine Street be broken at several points. This could be done by eliminating a section of the street where existing land development would permit it without involving the legal right-of-access to adjacent properties. Only one or two such interruptions would be needed to discourage "through traffic" from using Lamartine Street and to encourage use of the proposed arterial.

Significant traffic reductions can also be anticipated on several of the other streets parallel to the proposed arterial. Washington Street would experience the greatest decrease in traffic volume largely because the geometric realignment that would be made just north of Forest Hills. The continuity between Washington Street and Hyde Park Avenue would be changed to emphasize the arterial street in preference to Washington Street.

Forest Hills, South, and Centre Streets as well as Jamaicaway, Columbus Avenue and Seaver Street would all experience some traffic reduction with the arterial constructed to Forest Hills in comparison to the no-build alternative. The amount of traffic reduction would not be as great as on the other streets already mentioned.

<u>No Build vs. Arterial Built to Jackson Square</u>

As previously indicated, the important difference between the traffic assignments for 1980 and 2000 would be a 10 percent increase in the volume of traffic by 2000 compared to 1980. This incremental increased percentage traffic volume would apply to each of the three basic alternatives.

To illustrate the changes in traffic volume expected during the years 1980 to 2000, a comparison can be made at Massachusetts Avenue - the same location previously discussed. We will use the same cordon line immediately north of Massachusetts Avenue, including all streets between Huntington Avenue and the Southeast Expressway ramps. The total volume of traffic, with the no-build alternative, projected to cross this line in the year 2000 is 144,000 vehicles compared to a 1980 total of 130,000 vehicles. The projected volume crossing this cordon line would be expected to increase to 147,000 vehicles daily under the "Arterial Built to Jackson Square" alternative and to 152,000 vehicles daily with the Arterial built to Forest Hills. The impact of the projected increase in traffic on the individual streets is shown below:

Projected Daily Traffic Volumes[1]
(in thousands)

Street	No Build 1980	No Build 2000	Arterial Build to Jackson Square 1980	Arterial Build to Jackson Square 2000
Huntington Avenue	22.0	24.0	22.5	24.5
Columbus Avenue	15.0	16.5	11.0	12.0
Tremont Street	18.0	20.0	16.0	17.5
Shawmut Avenue	3.0	3.0	3.0	3.5
Washington Street	13.0	14.5	11.5	12.5
Harrison Avenue	8.0	9.0	9.0	10.0
Albany Street	13.0	14.5	17.5	19.0
Southeast Expressway Ramps	38.0	42.0	43.5	48.0
Total	130.0	144.0	134.0	147.0

[1]Screen line at Massachusetts Ave.

The pattern of traffic anticipated in the year 2000 would be essentially the same as in 1980. The streets that would be expected to absorb the greatest daily increases in traffic (comparing 1980 No Build with 2000 Arterial Built to Jackson Square) would include Huntington Avenue (2,500), Harrison Avenue (2,000), Albany Street (6,000) and the Southeast Expressway Ramps (10,000). Because of the geometric changes anticipated on Columbus Avenue in the vicinity of Ruggles Street, it is expected that the volume of traffic using Columbus Avenue would decrease between 1980 and 2000.

Shawmut Avenue and Washington Street would be expected to remain substantially unchanged between 1980 and 2000.

Comparing the projected 1980 daily-traffic volumes on the No Build alternative with the corresponding 2000 volumes on the Arterial Built to Jackson Square alternative, the streets that would receive the greatest increase in traffic volumes would be Lamartine Street (2,000 to 2,500 vehicles), Armory Street (1,000 to 1,500), Centre Street (2,500), Washington Street - south of Forest Hills (1,000), north of Forest Hills (1,500), south of Columbus Avenue (2,000), and north of Columbus Avenue (1,000). Other streets with similar projected traffic increases include Hyde Park Avenue (2,000), Forest Hills Street (1,500), South Street (2,500), Centre Street - south of Jamaicaway Circle (5,500), Jamaicaway (4,500). In the section where the proposed arterial street would replace Columbus Avenue, the projected daily volume in 2000 would increase to about 47,000 vehicles daily on the Build to Jackson Square alternative. As previously described, the local side streets between Jackson Square and Forest Hills would not receive any traffic relief with the Arterial built only to Jackson Square. The projected daily traffic volumes for the year 2000 for the No Build, Arterial Built to Jackson Square and Arterial Built to Forest Hills are shown on Figures V-9, V-10, and V-11 respectively.

Traffic volume on Greenough Avenue was a concern raised at the Southwest Corridor Public Hearing. Even though a very large number of the more local residential streets were coded into the computer representation of the total street network of the Jamaica Plain area, not all streets could be included. In the computer representation, there were many cases where a pseudo-link was coded to represent two or more relatively minor streets or several minor streets combined with one major street. This was the case with Greenough Avenue which was combined, along with Seaverns Avenue into a pseudo-link with Green Street. The end result is that no precise traffic loading on Greenough Avenue was directly available. However, the loading on the pseudo-link was 7,500 vehicles in the "Build to Jackson Square" alternative and 9,500 vehicles in the "Build to Forest Hills" alternative. These two figures have been further disaggregated, by hand with an estimated volume of 1,500 and 2,500 vehicles made for Greenough Avenue in the two alternatives. This additional loading on Greenough Avenue in the "build to Forest Hills" alternative is somewhat typical of what would be expected to happen on streets which access the proposed Segment #3.

The location of traffic counts taken during 1975 by Frederic R. Harris, Inc. and the Massachusetts Department of Public Works and the reported 1980 and 2000 traffic projections for Morton Street are at the same location; i.e., east of the intersection of Morton Street with Forest Hills Street. Both the traffic counts and projected volumes are east of that intersection and thus consistant. The respective volumes are somewhat less than 40,000 vehicles for the traffic count (the machine figure of about 41,000 appears several thousand vehicles high when compared to a manual count taken at the same place at the same time for a portion of the counting period as part of the O-D Survey conducted by Frederic R. Harris Inc.) 38,000 for the 1980 "Build to Jackson Square" alternative, and 36,000 for the 1980 "Build to Forest Hills" alternative.

No Build vs. Arterial Build to Forest Hills (2000)

The projected daily volumes in 2000 with the Arterial Build to Forest Hills would attract additional traffic into the corridor in the same manner as described earlier relating to 1980. At the Massachusetts Avenue cordon line, the total volume in 2000 would be expected to be about 152,000 vehicles daily compared to the 130,000 in 1980 for the No Build alternative. The following tabulation shows the expected distribution to the various streets for the Forest Hills alternative for 1980 and 2000 compared to the 1980 No Build projections.

Projected Daily Traffic Volumes[1]
(in thousands)

	No Build	Arterial Built to Forest Hills	
Streets	1980	1980	2000
Huntington Avenue	22.0	25.0	27.5
Columbus Avenue	15.0	11.0	12.0
Tremont Street	18.0	16.0	17.5
Shawmut Avenue	3.0	3.0	3.5
Washington Street	13.0	10.5	11.5
Harrison Avenue	8.0	9.0	10.0
Albany Street	13.0	18.5	20.0
Southeast Expressway Ramps	38.0	47.0	50.0
Total	130.0	140.5	152.0

[1]Screen line at Massachusetts Avenue

The streets that are expected to receive the greatest impact in the year 2000 include Huntington Avenue, Harrison Avenue, Albany Street, and the Southeast Expressway ramps. Columbus Avenue traffic volume would be expected to decrease while the volume on the other streets including Tremont Street, Shawmut Avenue and Washington Street would be expected to remain substantially constant with respect to projected 1980 volumes.

The basic change in the pattern of travel in the study area would be the same in the year 2000 as previously described for 1980 with the arterial street built to Forest Hills. The streets running parallel to the arterial street would experience varying amounts of traffic relief while the streets perpendicular to the proposed arterial street would generally experience an increase in traffic because of the attraction that the arterial would create.

Very significant traffic reductions would occur on Amory and Lamartine Streets because of the design changes included in the proposed arterial street plans which would reduce the attractiveness of these streets to through traffic. This would mean that Amory and Lamartine Streets would be used almost exclusively for local access to adjacent properties. Other streets that would experience significant reductions in traffic with the arterial constructed to Forest Hills would include Washington, Forest Hills, and Centre Streets. Smaller reductions in traffic volumes would be experienced on the Jamaicaway, Columbus Avenue, and Seaver Street. The projected daily traffic volumes for the year 2000 (with the arterial street constructed to Forest Hills) is shown on Fig. V-11.

Truck Traffic in the Southwest Corridor

There is relatively little available in the form of actual classification counts which discern truck traffic for streets in the inner portion of the Southwest Corridor. However, during the past several years, counts have been taken on four of the more major streets with the following results:

Columbus Avenue	-	5% trucks (of the total counted volume)
Harrison Avenue	-	9% trucks
Tremont Street	-	6% trucks
Washington Street	-	14% trucks

These percentage figures for trucks are all in the range that would be expected on a major urban arterial street. It seems quite reasonable to believe that something in the range of 9 to 11 percent of the traffic on the proposed Segment #3 of the arterial street would be trucks. There has been a question raised that the proposed arterial street would become a major truck routing from Downtown Boston (the Central Artery) to the areas south of Forest Hills; perhaps routing all the way to Route 128/I-95 and beyond. This does not appear to be reasonable. The disconnection to this routing caused by the termination of the arterial street at Forest Hills with a series of traffic lights along its course is for all practical purposes the same situation that now exists with Washington Street. Since Washington Street does not now exist as a major truck route of regional importance, there is no reason to believe that the proposed Segment #3 of arterial street would suddenly become one.

Arterial Segment #3 and Its Impact Upon Patronage in the Relocated Orange Line

The question of whether building Segment #3 of the Arterial Street would have an effect on ridership on the Relocated Orange Line was raised on several occasions at the Public Hearing. Several speakers said that a decrease in transit usage would occur if Arterial Segment #3 were constructed. In several instances the statement was also made that it did not make sense to provide a "competing" highway facility to the proposed transit service. The question is

whether the inclusion of Segment #3 in the overall street network would improve highway travel conditions, particularly in the peak commuting periods of the day, to the point where any significant shift in modal split would occur; specifically a shift away from transit usage to automobile usage.

Any shift in modal split might be the result of decreased travel time for vehicles from the Southwest sector of the region. No significant shift is predicted because the travel time for persons using the Arterial Street between major origin/destination areas is not changed significantly by the addition of Segment #3. In as much as Arterial Segment #2 is not in question (since Columbus Avenue and Tremont Streets already perform an arterial function), the routing from Forest Hills to Jackson Square is the significant area for comparison of travel time in the "Build" and "No Build" Arterial Segment #3 question.

Current routings of traffic on Washington and Centre Streets require that several local shopping areas and traffic signals be negotiated before proceeding north on the proposed Arterial Segment #2 from Jackson Square to Downtown.

Inasmuch as Arterial Segment #3 between Morton Street and Jackson Square is planned with at least 6 traffic signals, it is anticipated that no significant saving in travel time will be gained if Segment #3 is constructed in addition to Segments #1 and #2. Volumes of traffic drawn to Segment #3 will, of course, be drawn to it in part because of initial travel time savings and apparent ease of access; as volume on Segment #3 increases, these savings will diminish or disappear.

Other shifts in volume from Lamartine and Amory Streets will be due to the selective closing and detouring of traffic from these streets to the Arterial and the perceptual difficulty of negotiating Centre and Washington Streets.

5.1.7 Level of Service

Evaluation of the level of service expected from the proposed arterial street is based on the conditions that would be likely to prevail at the various intersections along the arterial. Projected daily traffic volumes for 1980 and 2000 (including estimated turning movements at the important intersections along the arterial) were provided by the Central Transportation Planning Staff.

Based on estimates of daily traffic volumes, AM and PM peak-hour traffic volumes were calculated for each of the major intersections. Area traffic counts indicate that an average of about 8 percent of the daily travel occurs during each of the peak hours. These counts also indicate an average directional split with about 60 percent of the travel inbound during the morning peak hour and 40 percent outbound. During the afternoon peak, the directional emphasis reverses with about 60 percent outbound and 40 percent inbound. Intersection-capacity calculations were made based on these average values for peak-hour and directional emphasis.

The key intersections examined for capacity and level of service evaluation include the following:

- Arterial Street at Tremont/Columbus/Arterial Segment #1
- Arterial Street and Ruggles Street
- Arterial Street and Tremont/New Dudley Streets
- Arterial Street and Centre Street/Columbus Avenue (Jackson Square)
- Arterial Street and Morton Street
- South Street and Relocated Morton Street (extended)
- Relocated Washington Street and a new roadway connecting to Hyde Park Avenue
- Hyde Park Avenue and a new roadway connecting to Washington Street

Using these estimated values of turning movements, peak-hour volumes, and directional-movement capacity, the resulting levels of service have been calculated for AM and PM peak periods. A level of service of "C" can be obtained at six of the intersections during the morning peak hour in 1980. This can be achieved by providing additional left-turn lanes at the intersections of the Arterial Street and the intersection of the Arterial Street and Morton Street. At Jackson Square, a level of service "D" can be anticipated during the morning peak hour in 1980 providing additional intersection approach lanes are provided both on the arterial northbound approach and on Centre Street. Further design will seek to improve the level of service at Jackson Square to level "C".

During the afternoon peak hour in 1980, the level of service is expected to be a little more than during the morning peak hour because of the concentration of turning movements anticipated during the afternoon. With the modifications mentioned above, a level of service of "C" can be expected.

By the year 2000, the projected growth in daily traffic would be reflected proportionally in the morning and afternoon peak hours. Because the projected volume increase by the year 2000 is relatively small, only minor changes in the level of service should be anticipated. It is estimated that a level of service "C" can be achieved during the afternoon peak hour in the year 2000.

5.1.8 Pedestrian Impacts

A comparative analysis has been made of the locations where pedestrian crossings of the railroad right-of-way can be made presently or would be provided under each of the alternatives. The tabulation shown in Fig. V-12 identifies the location and the alternatives having pedestrian crossing capabilities.

Note that in the section between Tremont Street in South Cove to Tremont Street in Roxbury, the number and location of pedestrian crossings of the railroad right-of-way would be the same for all alternatives with only three exceptions.

Ruggles Street Station facilities including the bus circulation roadway would be constructed in this same area. The character or quality of the pedestrain crossing would be greatly improved in all of the build alternatives in comparison to the present 10-foot-wide underpass.

The proposed Ruggles Street Station would provide a spacious, lighted, and enclosed (protected) area providing pedestrian access to the station facilities from both sides of the rail right-of-way. In addition to the station a separate bus-circulation bridge would be included in each of the build alternatives. This bridge would be located at the north end of the station area. It would be built primarily for bus circulation but could also provide for pedestrian crossings as well.

Comparing the pedestrian crossing opportunities between Ruggles Street and Centre Street, the number and relative location would essentially be the same for all alternatives including the No Build. However, each of the build alternatives would provide more spacious and better lighted areas for pedestrian crossings than presently exist. Station Street is eliminated due to its proximity to Centre Street. Cedar Street is extended across the railroad to provide new access to the residential and industrial area on the west side of the tracks in the Modified and Post Hearing Alternatives.

In the section between Centre Street (Jackson Square) and Boylston Street, pedestrian crossing opportunities would be provided at Atherton/ Mozart Streets in all Build alternatives as well as the No-Build alternative. In the Modified Embankment - Arterial East to West alternative a new vehicular underpass with associated sidewalks would be constructed 300 feet south of Atherton Street. The other Build alternatives would not require this structure

and would have no pedestrian crossing opportunity at this location. However, four of the Build alternatives would have a bridge structure at Paul Gore Street which would not be included in the Modified-depressed Alternatives or the Depressed Rail/Transit Post-Hearing Alternatives. The Paul Gore Street Bridge structure would be closely associated with Boylston Station. The station design would provide additional pedestrian crossing opportunities not available with the No-Build alternative. All schemes including the No-Build would have pedestrian crossing opportunities at Boylston Street. The quality of pedestrian crossings provided with any of the Build Alternatives would be superior to those which now exist.

South of Boylston Street an existing pedestrian underpass would be eliminated by any of the build alternatives. A new bridge at Minton Street would replace this crossing capability in alternatives FH-1, FH-2 and FH-4. In the depressed-rail alternatives, a new pedestrian bridge could be constructed to provide a more direct pedestrian connection from the high land along Oakdale Street to the community facilities east of Amory Street. The vehicular bridge at Green Street would provide pedestrian connections under all alternatives. In the Post Hearing Alternative a recreational deck has been included between Lorene Place and Oakdale Street providing continuous access across the depressed rail/transit facility - particularly to Lourdes School and the Jamaica Plain Neighborhood House.

The new Green Street Station would provide a new pedestrian connection not available under the No-Build alternative. Similarly, the extension of Gordon Street would provide additional pedestrian flexibility with all alternatives except alternative FH-4 or the No-Build alternative. Pedestrian connections would be provided at Williams and McBride Streets with all alternatives. A recreational deck is added between these two streets in the Post Hearing Alternative also providing pedestrian access to the new Southwest II High School from the South Street neighborhood.

In the Forest Hills Station area, major changes in pedestrian circulation would be associated with each of the build alternatives in contrast to the conditions presently existing. The major station complex would provide for internal pedestrian circulation for transfer between the various modes of public transportation. This internal circulation would also provide for direct station accessibility for kiss-and-ride as well as park-and-ride patrons.

With a No-Build Arterial Street alternative, pedestrians would be required to use the existing sidewalks and intersections. The most important intersections are controlled by traffic signals including pedestrian signals

Assuming the No-Build Arterial was to be combined with any of the Build-Rail alternatives, the number of pedestrians using the street crossings would increase substantially. This increase would be caused by persons walking to and from the new Orange Line Stations and persons walking to and from the new land uses in the area including such major pedestrian oriented facilities as the Campus High School, the proposed Roxbury Community College, and the proposed Jamaica Plain II High School. Many other new facilities would further add to the number of pedestrians in the area.

Each of the Build Arterial alternatives would provide improved pedestrian facilities along with improved facilities for motorists. Each of the major intersections would be signalized for both motorists and pedestrians. The number of signalized intersections would be increased, thereby providing greater pedestrian protection. The facilities that would be provided would be essentially the same for each alternative.

At Forest Hills, a pedestrian overpass crossing Hyde Park Avenue would provide a conflict free route for pedestrians to gain access to the new station complex from the east. This quality of pedestrian protection is not presently available at Forest Hills. In fact, one of the heavily used access doors of the present Orange Line Station opens directly onto Hyde Park Avenue. There is no sidewalk adjacent to the building so that there is no visibility of pedestrian and/or motorists at this location.

5.2 Project Construction and Impacts During Construction

This impact analysis considers alternatives in which several major factors are significant to the development of construction contract limits, methods, costs, procedures, sequence, duration and impacts.

For example, between Camden Street and Forest Hills, two depressed Rail/Transit alternatives (FH-1 and FH-2) require the removal of large quantities of excavated materials (3,000,000± cubic yards). The excavation generates construction costs, methods, duration and impacts unique to that segment. The Rail/Transit facility built on a modified embankment on the other hand, has its own set of construction particulars.

The Arterial Street, in purely construction terms, can be viewed as a separate facility which has little or no influence upon Rail/Transit construction. The street then, if built, could be constructed as a singular undertaking.

Between Camden and Dartmouth Streets, the alternative SC-1 lowers the existing Penn Central track bed sufficiently (2-5 feet±) to allow minimum bridge clearances for intercity rail and transit service.

The Back Bay-to-South Cove segment considers the construction options for the Orange Line as being either approximately at existing track grade throughout, or in tunnel from South Cove to Dartmouth Street.

Over the entire project length two options are possible: either to maintain rail service within the Penn Central right-of-way or divert it to the Midland Division during construction.

The construction contracts and limits, defined in Section 5.2.1 below, were developed from logical break points which take into account the above mentioned considerations as well as methods and types of construction to be encountered, i.e., heavy earthwork and reinforced concrete, station and architectural work, roadwork, power, signals and communications. Other factors determining contract limits include: geophysical aspects, size of contracts, disposal of materials from the construction areas, delivery of materials and prefabricated items to the sites, population density in the project area and environmental concerns.

These limits or break points could be at the following locations irrespective of the alternative chosen.

South Cove	Project limit-North
Camden Street	Beginning point for major earth moving contracts (cut or fill)
Mozart Street	Mid point for equal division of earth moving contracts (cut or fill)
Forest Hills	Project limit-South

The demolition of the Washington Street elevated structure is conceived as one or two construction contracts between South Portal and Forest Hills to be executed after the new Orange Line is operative.

5.2.1 Construction Contracts

A project of this size has many diverse special items of work divided into a number of contracts. The number and type of contracts relates to the quantities involved, working and site restraints, and the need for contractor specialization in certain fields.

Analysis of these factors reveals that the project would most advantageously be made up of the contracts listed below, regardless of alternatives selected:

- 3 General Civil contracts for earthmoving, drainage, bridges, walls, landscaping, noise barriers. One contract (Contract #1) would be between the proposed South Cove Tunnel Portal and Camden Street. Two additional contracts (Contracts #2 and #3) would be employed so as to allow excavation volumes (cut or fill) to be divided equally between Camden Street and Forest Hills.
- 1 or 2 contract(s) for Arterial Street and Miscellaneous side-street improvements - grading, paving, lighting, utilities, etc.(Contract #4a & 4b)
- 2 Contracts for railroad and rapid-transit track work (Contract #5a & 5b)
- 1 Contract for Orange Line power, including sub-station equipment (Contract #6)
- 2 Contracts for signals and communications - one for railroad, another for transit (Contract #7a & 7b).
- Passenger stations contracts and electric sub-station contract (building only). From one to three passenger stations could be let as a single contract, depending upon their size and complexity. Three Station Contracts were assumed for analysis purposes:

  8a & b Back Bay, Massachusetts Avenue;
  8c & d Jackson Square/Roxbury Crossing, Ruggles;
  8e & f Boylston Street/Green Street, Forest Hills.

- Demolition of Washington Street elevated structure (Contract #9).

5.5.2 Construction Procedures and Phasing

Regardless of the alternative selected, from among the "build" possibilities, it is clear that the Southwest Corridor project represents a significant construction undertaking. As such, a definition of construction contract limits, phasing, duration and costs is important in determining impact. It should be noted that the definition of construction method and sequence is intended only for purposes of describing impact; actual construction method is dependant upon final engineering and contractor preference within the limits specified by the construction documents

This sub-section deals with the nine basic contracts (suggested in 5.2.1 above) including one method of anticipated construction procedures and phasing of work.

5.2.2.1 Contract #1 - Line Segment - South Cove to Camden Street (SC-1, PHP-1, PHP-2)

As part of the South Cove project, the Orange Line would be constructed as a shield-driven tunnel crossing under the Massachusetts Turnpike Extension (Fig.IV-69, Detail A). Construction at this point for the Orange Line transitions from a shield-driven twin-arched tunnel to a cut-and-cover twin box (Fig.IV-69, Detail B). This transition brings the MBTA tracks from a 10° curve (R= 573') in the tunnel to an alignment parallel with the existing tracks above. The depth of cut for the twin box ranges from about 27 feet at the end of the tunnel to about 21 feet at the end of the twin box, which is also the portal - located approximately 200 feet east of Tremont Street viaduct.

From the portal, the Orange Line construction changes to an open cut U-shaped boat section with a heavy-bottom slab, ascending to the existing grade at 4 percent (Fig.IV-69, Detail C). The Orange Line at this point is located to the south of the two relocated Boston and Albany railroad (B&A) tracks and north of the three proposed Amtrak and commuter-rail (railroad) tracks. The B&A tracks will be relocated slightly to the north. The railroad tracks are also shifted slightly southward.

The northeast contract limits for Contract #1, Alternatives SC-1, PHP-1 and PHP-2 are different for the Orange Line and the Railroad. Orange Line construction begins where the South Cove project meets existing track grade. Railroad construction, on the other hand, starts further east cutting approximately 2 feet from existing track grade under Arlington Street to allow 17'-8" vertical clearance.

The geometry of the tracks westward is strongly influenced by the proposed track and platform configuration at the Back Bay Station. The railroad platforms for the station extend from east of Dartmouth Street to east of Berkeley Street and require property takings along the southern right-of-way line.

As part of the relocated Orange Line project the viaducts that cross the right-of-way at Berkeley Street, Columbus Avenue, Clarendon Street and Dartmouth Street would be rebuilt since the southern abutment and the piers in each case will have to be relocated to accommodate the new tracks and platforms. Where these viaducts and bridges are rebuilt it will not be feasible to raise the structure in order to increase the headroom clearance over the tracks to 17'-8" (existing clearance varies between 15'-10" and 16'-6") because it is necessary to maintain present street grades. Furthermore, moving the new tracks to the south decreases the available headroom at the relocated southern abutment, since street grades on the viaducts generally slope down in the southerly direction. If a 17'-8" vertical clearance is desired, it will be necessary to depress these tracks by about 2 feet. This 2± foot depression would be maintained throughout for the railroad tracks.

All bridges for local streets crossing over the railroad right-of-way will be reconstructed to their original widths and/or upgraded in conformance with FHWA proceedures in cases where FHWA funding is utilized. The existing retaining wall along the south side of the right-of-way from Berkeley Street to Clarendon Street will be relocated south as much as 40 feet.

The Orange Line and the relocated B&A tracks will remain at the present grade north of Back Bay station. The difference in grades between the lowered railroad and the southerly or inbound track of the Orange Line can be maintained by a low retaining wall.

5.2.2.1.1 Back Bay Station Area

The existing Back Bay Station on Dartmouth Street will be rebuilt to accomodate the 7 tracks proposed (3 railroad, 2 MBTA, 2 B&A), together with their various platform requirements. To accomplish this, the entire width existing between the face of the Heath Building (corner of Columbus Avenue and Buckingham Street) and the Hancock Garage (abutting the right-of-way) will be utilized. The Heath Building and the Hancock Garage can be maintained intact since their footings are founded well below the required excavation grades for the proposed Back Bay Station facility. However, the Heath Building will require some slurry cut-off wall construction below present basement level. The limited space available dictates that the proposed southerly railroad platform abut directly against the building's basement.

Columns will be constructed above the basement level to support a deck which spans the entire width between the Heath Building and the Hancock Garage (Fig. IV-69, Detail D).

Below the deck, the two existing B&A tracks are to be maintained and five new tracks are proposed - three for railroad and two for Orange Line. The two Orange Line tracks will be served by a center platform, 23 feet wide at its widest and 410 feet long running along a R = 4,000' curve. The three new railroad tracks to the south will have two high platforms - one center platform 1,200' long and tapering from 24' to 12' in width, another 1,200 foot side platform, 12' to 24' wide. The two platforms will be on a 30-minute curve (R = 11,459') and will be designed to serve Amtrak passengers as well as commuters. The proposed railroad platforms are the same for the tunnel option (Section 5.2.2.2) except the locations are shifted some 30 feet to the north.

Buckingham Street between Dartmouth and Clarendon Streets will be relocated and integrated with the Back Bay station over the tracks. Existing utilities under the street will have to be relocated to other streets or maintained in the space above the railroad platform. The Buckingham Street exit to Clarendon Street will be relocated north of the existing one in order to provide station platform egress, convenient drop-off lanes for the station and improve the intersection of Clarendon Street and Columbus Avenue.

5.2.2.1.2 Construction South of Back Bay Station

Between Back Bay Station and Camden Street, the five proposed tracks (with walls and supports for an overhead deck) will require a width of 70 feet. The existing 66 foot right-of-way will have to be widened on the easterly side encroaching on existing Claremont and Carleton Streets. Takings will be necessary on the east side of the tracks at both the north and south edges of Massachusetts Avenue.

The southerly tracks would be reserved for AMTRAK and commuter rail and the northerly two for the Orange Line. Railroad clearances will be increased from 16' ± to 17'-8" under bridges in this reach by removing at least 2 feet of existing subgrade and placing the 5 tracks on ballast (Fig. IV-69, Detail E). The subgrade can be drained without appreciably lowering existing groundwater levels. The Orange Line will be lowered by approximately 2 feet south of the Back Bay station with the three railroad tracks being dropped an additional two feet to better accommodate the proposed roof deck. Preliminary investigations indicated that existing walls and buildings abutting the right-of-way will not be structurally affected by the proposed depression in this area.

5.2.2.2 Contract #1 Tunnel - South Cove to Camden Street with Orange Line Tunnel Option(SC-2)

The northerly work limit for Contract #1 Alternative SC-2 would be at the southerly termination of the bored portion of the Orange Line tunnel. At this point, the tunnel has already passed under the Massachusetts Turnpike. The bored tunnel configuration adopted consists of twin arch shaped tunnels for inbound and outbound Orange Line (see Fig. IV-69A,Detail A). It is aligned in such a manner as to allow the Orange Line to proceed parallel to and beneath the existing Penn Central trackage.

As soon as the Orange Line alignment has been brought parallel to the existing tracks above it, the shield-driven tunnel construction can be stopped and the construction method can be changed to twin side-by-side cut-and-cover boxes. This changeover also required a transition section (Fig.IV-69A,Detail B) which will bring the tracks from 20 feet on centers and approximately 27 feet below railroad track grade back to 15 feet on centers and about 21 feet below track grade. Using a 10 degree curve (R = 573') and spirals for 40 mph-train-operating speed at this point makes the transition section approximately 200-feet long. At the end of the transition section the Orange Line continues westward in a close-

coupled, shallow twin-box structures built by cut-and-cover methods. At the same time, the railroad tracks will be lowered to allow 17'-8" vertical clearance throughout the project length.

The ground water level is high in the depressed right-of-way cut between Shawmut Avenue and Camden Street and wide spread construction dewatering would be expected to cause adverse settlement of the adjacent retaining structures and buildings. Foundation-pile deterioration is also possible. Dewatering would also be expected to be excessively slow and expensive due to the silts and clays present in the general area.

To avoid having to dewater the general subsurface area, the cut-and cover construction method proposed will permit the water table to remain high. This is accomplished by driving tight sheet piling on both sides of the proposed trench to a point approximately 35 feet below track grade, excavating the trench in the wet and placing a substantial tremie concrete bottom sealing slab to stabilize the excavation bottom. The excavation is then progressively dewatered and the sheet piling is cross-braced by means of walers and struts at various elevations as soon as dewatering levels permit.

Once the trench is fully dewatered and braced, the construction proceeds in the dry. A thin, lean concrete leveling course will be placed between the tremie concrete and the structural concrete of the normal or transition twin-box structure to provide a reasonably level starting point.

After completion of the box structure the trench cross-bracing will be removed and the sheet piling will be pulled where possible. Re-use of the available sheet piling and walers and struts is contemplated with a normal attrition allowance for repeated usage.

The alignment proposed will permit the use of the southerly two Amtrak tracks and northerly Boston & Albany track during construction of cut-and-cover twin-box track structure (see Fig. IV-69A, Detail C). The distance between centers of the northerly Penn Central railroad and the southerly B&A track varies between 68 and 79 feet, leaving from 11.5 to 15 feet between operating track centers and face of sheet piling for the required 43-foot excavated Orange-Line trench width.

The only exception is in the transition structure area connecting the twin shield-driven tunnel section with the close-coupled twin-box section. The transition structure at its widest point requires a trench width of approximately 50 feet between faces of sheet piling. In this reach it is proposed to temporarily relocate the northerly B&A track some 5 feet north closer to the Massachusetts Turnpike in order to provide a ten-foot clearance between operating track center and sheet-piling face.

Construction of the cut-and-cover transit tunnels under the existing railroad cut will require the removal from service, of the various street bridges and viaducts presently crossing the depressed Turnpike and railroad right-of-way. These structures will have to be taken out of service one at a time in order to minimize traffic rerouting problems. They will be partially or completely dismantled over the railroad right-of-way to permit the cut-and-cover operations for the transit line to proceed. These bridges will be rebuilt and their pier locations will be integrated with the new transit twin box structure.

5.2.2.2.1 Back Bay Station Area

The close-coupled twin-box structure for the Orange Line will run from under the Tremont - Arlington Street viaducts to a point between the Clarendon and Dartmouth Street bridges, where the proposed Back Bay transit station will be located and integrated with the proposed rebuilding of the Back Bay railroad facility. The type of transit station

structure best suited to the twin-box line structure would incorporate a shallow, side platform for the Orange Line (see Fig. IV-69A, Detail D). The shallow side platform configuration has the advantage of reducing construction costs and difficulties, elimination of vertical transitions before and after the platform and reducing the total project structure length. The side platform layout also eliminates costly horizontal track spreading transitions at both station ends that are required whenever close-coupled twin tracks are to be connected to a station utilizing a center platform. In order to remain shallow, the passenger interchange between future railroad and Orange Line users will be at street level grade. The present Back Bay station will have to be removed down to railroad level in general and down to the column footings within the area occupied by the twin-box line structure or the station structure. The construction of the transit portion of the Back Bay station would be accomplished by the same sheet pile lined trench described for the close-coupled twin-box line structure, but in this case the trench required is approximately 60 feet wide.

5.2.2.2.2 Construction South of Back Bay Station

West and south of the proposed Back Bay Station the transit track tunnel alignment swings to the westerly side of the present depressed railroad right-of-way and comes up to grade north of Harcourt Street. The track structure changes from twin-box structure to an open-cut "U"-shaped structure of diminishing depth (see Fig. IV-69A, Detail E). The "U"-shaped structure is constructed by the same building scheme as described previously, utilizing cross-braced sheet pile trench walls and a tremie concrete base slab to control uplift and buoyancy forces. As the transit grade rises the construction becomes lighter, and when the transit top of rail comes to within 3 feet of existing grade the "U" shaped structure is discontinued and the remaining section is built in simple cut.

The open-cut "U" shaped structure starts at the tunnel portal approximately 220 feet south of Dartmouth Street, and ends at a point 650 feet south of Dartmouth Street. To allow room for the structure, the existing low retaining wall between the Massachusetts Turnpike and the railroad right-of-way would have to be relocated about three feet to the west infringing on Turnpike property.

Between Back Bay station and Camden Street, the five proposed tracks would be accommodated in a 70-foot right-of-way. Construction techniques utilized to provide 17'-8" vertical clearance for all tracks are as described previously in Section 5.2.2.1.2 (see Fig. IV-69A, Detail F).

5.2.2.3 Contract #2 Depressed - Camden Street to Mozart Street Rail Service Discontinued During Construction (FH-1, -2)

Due to the large quantities of earth to be removed between Camden Street and Forest Hills, it is considered desirable to divide the total quantities equally between those two points, removing half to the north and half to the south on rails. Mozart Street, therefore, would represent the contract limit-south for Contract #2. Camden Street would represent the contract limit-north. Station construction is anticipated as separable from the line segment work and would proceed in proper sequence but under different contracts.

Earth excavation would be accomplished with the use of heavy equipment, such as front end loaders, large trucks and cranes. The excavated material would be loaded into railroad gondolas for disposal. There are no spoil areas available in the immediate greater Boston area and hauling vast quantities of earth through the narrow, crowded streets is unacceptable; it slows construction progress and impacts adjacent communi-

ties. Movement of the excavated material by railroad to the north for this contract is feasible.

As the existing embankment would be excavated and the material hauled along the right-of-way to a loading point, existing structures could be removed and also disposed of via rail.

At an optimum distance behind the excavation of existing railroad embankment, steel sheeting would be driven on both sides of the proposed below-ground structure to the depth necessary for this excavation and construction. Provision would be made for utilities crossing the right-of-way by placing them in permanent or temporary locations as found necessary or desirable.

Upon completion of a portion of the sheeting, below-ground excavation would proceed. When the water table is reached, excavation would continue with "clam shells" or other equipment suitable to the conditions encountered. Excavation may be completed in the wet and "tremie" concrete (waterproof) used for the bottom slab between sheeting walls. Upon completion, dewatering may proceed by means of open pumping to permit the remaining concrete work to take place in the dry. Recharging of adjacent ground water table may be necessary during the dewatering period. Form work, reinforcement and finally concrete placement would be started and continued by increments to completion as excavation and sheeting proceeds ahead. Sheeting would be pulled after concrete is placed and reused further ahead prior to progress of below ground excavation. During the concrete placement, provisions would be made for station platforms, egress, drainage, ductwork, utilities, safety nitches, etc.

The option to construct retaining walls with integral bridge seats could be considered. This would provide built-in capability to add decking, where practical, at some future date should a desire or need for it develop.

Temporary street crossings would be replaced by permanent bridge structures and utilities would be positioned in their final location.

Track work, the work on the passenger stations, arterial road, power signals and communications would be initiated as the work becomes feasible in relation to concrete installation.

As the need for access to the construction site decreases, landscaping and noise attenuating measures will get underway with the final fencing being installed to insure safety and secure the site.

5.2.2.3.1 Construction Methods

Reconstruction of the rail roadbed in a depressed section would require the building of new bridges over the right-of-way for local street circulation and accessibility of the proposed transit stations. New bridges will be constructed at the following locations:

Ruggles Street
Prentiss Street
Station Street
Tremont Street
New Heath Street
Heath Street
Centre Street
Mozart Street

Additional pedestrian bridges would be built as required.

All of the foregoing streets are presently spanned by railroad bridges which will have to be removed as the embankment comes down. Normally the bridge removal will take place while traffic continues to use the street. The only short period of interruption would occur when the actual heavy steel girders are actively being lifted out. This work would be scheduled for off-peak traffic hours so as to cause as little inconvenience to the public as possible.

The width of the depressed "boat section" between interior wall faces varies from a minimum of 72 feet for the standard tangent section to 100 feet in width at the typical transit station. However, a station such as Ruggles Street, where facilities will be provided for both transit and commuter rail patrons, will require a cross-section width of 177 feet in the station area.

The depth of cut for the depressed section will be approximately 25 feet below the grade of existing streets that presently cross under the railroad embankment. This depth is necessary to provide required vertical clearance for electrified rail and transit operations and leave sufficient room to install a new bridge overhead to carry cross-street traffic across the depressed rail/transit. While the cross-streets are the primary factor in determining depth of depression, the depth does fluctuate as the height of terrain changes between streets.

This depressed section will intercept numerous active utilities which presently cross beneath the Penn Central track area. It will be necessary to intercept these services and provide temporary support systems or temporary relocations to facilitate construction. Some of the gravity flow services such as storm drains and sewer services will be reconstructed in siphons under the depression while others will be finally relocated in utility bays provided in the new cross-street bridges.

Stony Brook Culvert is the major service to be contended with. At Roxbury Crossing this 17'-0" x 15'-6" drain will have to be relocated to permit construction of the depression. At Ruggles Street, large diameter branches of Old Stony Brook culvert will likewise require relocation prior for construction of the depression.

The Line Segment from Camden Street to Mozart Street includes all phases of heavy construction. Initial work would be the excavation of an above-ground embankment approximately 18 feet high with granite retaining walls along much of its length. It is anticipated that excavation would proceed from south to north, with heavy excavating equipment loading the material to hauler units that would transport the material along the right-of-way to a convenient loading point. At this location, the material would be elevated onto railroad cars and hauled northerly to distant spoil areas as determined during the design phase. Concurrently with this excavation, the retaining walls would be demolished and would also be loaded out. Cranes with stone hooks would assist in this operation.

During the excavation, ties and rail would be removed and ballast stripped and stored if and as specified. Ahead of and concurrently with the excavation, existing bridges would be demolished and the steel and debris shipped out via railroad.

As soon as a sufficient distance would have been graded to approximately ground level or below as found convenient, sheet piling would be driven on both sides of the right-of-way at the back footing line of the proposed concrete "boat" section. A second excavation operation would then proceed. When the water table would be reached, the area would be dewatered as necessary and equipment suitable for wet excavation introduced. In dewatering, the water table outside the sheeting line would not be affected as recharging would be undertaken as required.

At each designated crossing street, a temporary crossing bridge would be installed prior to subsurface excavation. As soon as the "boat" section wall was completed in each area, the temporary bridge would be replaced with a permanent structure.

As the sheeting operation would progress, existing utility installations, including drainage culverts, would be relocated or hung on supports crossing the cut area. Some utilities would require relocating more than once to expedite the excavating operation.

When excavation and utility protection would have advanced a feasible distance, dewatering (and possibly recharging) would begin so that a foundation layer of gravel could be placed, the concrete "boat" section formed, the reinforcement installed and concrete poured. The section would be poured transversely in continuous operations for predetermined lenghts.

Provision would be made for collecting storm water from the "boat" section and pumping the runoff to an existing surface system. If necessary, the surface system would be modified or revised to take the quantity collected. It is anticipated that the quality or quantity so collected would not be materially different than that now being discharged to the existing system.

An adequate pumping system would be installed with pumps fed by two separate power sources plus standby diesel/generator equipment. All systems will operate on automatic controls with emergency capabilities built-in.

When the "boat" section would have proceeded for an optimum distance, the sheeting would be pulled and reused, the concrete walls backfilled and the area landscaped and protected by security fence. Six-foot chain link fence would be the standard method of protection.

All utilities presently crossing the right-of-way would be relocated to and supported by the proposed crossing bridge structures. Since these proposed bridges would be in general, at or in the immediate vicinity of existing crossing streets, utility relocation is not considered to be a major problem. However, in isolated cases it may be necessary to support a utility on an individual structure.

The existing storm-water and sanitary system would require modification because of the introduction of the depressed transit facility. The quantity and quality of the runoff would not be affected. Pumping would be required at certain points. Major drainage work would be involved in lowering the Stony Brook Culvert, as well as a large adjacent culvert. Siphon reconstruction of these culverts may be required to underpass the rail/transit depression.

Track would be spaced on 13 feet centers for the relocated Orange Line and on 14 feet centers for the railroad, with 14 feet minimum between the Penn Central and the Orange Line. Eight-feet six inches would be allowed between the centerline of the outer tracks and the nearest obstruction (in this case, the "boat" section wall).

Rail would be 115-pound R.E. for the Orange Line and 132-pound R.E. for the Penn Central. All rail and fittings would be new. The open-cut area would be fenced with chain-link fence.

5.2.2.4 Contract #2 Elevated - Camden Street to Mozart Street - Rail Service Discontinued During Construction (FH-3, -4)

Construction over the entire length of this contract consists of widening and raising the existing embankment, an operation of relatively smaller magnitude when compared to the depressed alternatives. It is contemplated that suitable borrow material would be brought in and stockpiled prior to the detouring of railroad traffic. Rehandling of this material represents a major contract operation.

Existing railroad bridges over the local streets would be removed, the sub-structure demolished and new bridges constructed in more optimum locations. The new rail/transit structures would have longer spans to allow a more open atmosphere at the streets and sidewalks below. At station areas, bus drop-off and general station access also require wider street space, and therefore, longer bridge spans for the rail facility above. New retaining walls in the vicinity of the reconstructed bridges would be required. Pile support and consequently pile driving would be necessary for all bridge abutments, piers and retaining structures. The drainage and utility systems which currently cross the embankment at through streets require extensive reconstruction as flooding is currently a common occurence.

The project would be fenced and sound barriers included. Where possible, fencing and sound barriers would be combined to form a composite device which would provide adequate security. In addition, landscaping treatment for the elevated alternative, in an effort to mask the embankment would be much greater in scope as compared to the depressed alternative. Landscaping contracts, therefore, provide an important part of this general contract.

Construction scheduling is not considered complicated, but would require the demolition and construction of more than one bridge and station structure concurrently in order to expedite completion. Virtually all operations could be conducted concurrently throughout most of the length.

5.2.2.4.1 Construction Methods

Reconstruction of the railroad embankment to accommodate the five new tracks in this contract will require the demolition of existing and reconstruction of new bridges at the following streets:

Ruggles Street
Prentiss Street
Station Street
Tremont Street
New Heath Street
Heath Street
Centre Street
Mozart Street

In view of the fact that new bridges carrying rail/transit traffic will be wider than present bridges spanning cross-streets, it is anticipated that bridge construction will permit vehicle traffic to remain on present streets. Some restrictions may occur and short periods of closure might be necessary during placement of structural steel. During periods of pile driving for new bridge piers or abutments, it may be necessary to move traffic away from the immediate construction operation. It would appear that such a move can be readily accomplished with paved detours adjacent to the work site even if it is necessary to remove portions

of embankment which will ultimately be widened. In any event, traffic interruptions of any unavoidable nature would not be permitted during morning and evening peak traffic periods.

In the elevated design, the utilities in the existing cross-streets will be subject to some relocation to accommodate the foundations for new bridges. The relocations would not be major and would likely be accomplished with one move. Stony Brook Culvert, the major utility service in the corridor, will require some relocation at Roxbury Crossing where the facility would be subjected to new pressures from bridge construction and proposed retaining walls. The Old Stony Brook Culvert at Ruggles Street will not be sufficiently impacted to require relocation or a siphon.

The proposed embankment will be reconstructed, where possible, to a height that will provide smooth underpass street profiles and develop the City of Boston's desire for 16 feet of vertical clearance under bridges.

The proposed embankment will also be raised to a height that will permit elevating the grade of some of the existing streets which sag under the embankment. The elimination of street sags under the embankment combined with proper drainage systems preclude continued flooding during stormy periods.

The new embankment section will utilize existing granite masonry walls wherever possible together with newly constructed walls to contain the widened five track facility. The new embankment will have a normal minimum width of 80 feet from face to face of wall. Station areas, of course, would be widened to accommodate the new transit platforms.

The influx of new construction materials, wherever possible, would be handled by railroad. However, with the demolition of so many railroad bridges the utilization of city streets for some hauling access must be considered a reality.

Under the elevated option the additional earth material required for widening the embankment could be hauled in via rail car and stockpiled at a predetermined site. This would eliminate unnecessary cluttering of city streets except for the minimal rehandling from stockpile to placement area.

During this same period work could get under way for the demolition of portions of existing retaining walls and construction of new walls could begin. When the railroad no longer is critical for hauling in materials, bridge demolition and reconstruction would begin.

The demolition and reconstruction of bridges is the single most time consuming item of work in this contract. Bridge demolition will be accompanied or immediately followed by the relocation of utilities to provide an unimpeded work area for the new structure.

Bridge construction operations may very likely have to be scheduled so that major operations are not simultaneously taking place at two adjacent cross streets at the same time. While extensive precautions will be taken to protect traffic, the possibility of unnecessarily impacting the travelling public should not be permitted.

Since the embankment is of earthen construction, rain water will normally drain into the soil. At bridge overpasses, however, systems will be provided to catch all storm water and conduct it in a closed pipe to city drain systems. All bridge decks will be completely tight so that the dropping of debris onto the transit patron or the travelling public will be precluded.

The new five track system, like the depressed alternative, will have tracks spaced at 13 foot centers for the Orange Line and 14 foot centers for the Penn Central.

5.2.2.5 Contract #2 - Depressed - Camden Street to Mozart Street Rail Services Discontinued During Construction (FH-5, FH-6, PHP-1, PHP-2)

Construction of the modified depressed and Post Hearing alternatives involves removal of the existing track bridges, rails, ties and ballast, leveling of the embankment, reconstruction of the local cross streets, the construction of retaining walls, the placing of ballast, laying of tracks and all other tasks associated with the construction of a rail/transit facility.

The present rail facility is situated on an embankment located near the low point of a valley which the rail follows in this area. The proposed modified depressed alternative would locate the rail/transit tracks about 10 feet below the surrounding terrain. In order to construct the facility in a depressed section and to bridge the local streets over the rail/transit facility the surrounding terrain would have to be raised ten to fifteen feet along the length of the contract.

Construction scheduling for this alternative is considered complicated mainly due to the difficulty in maintaining cross traffic throughout the Corridor.

5.2.2.5.1 Construction Methods

This alternative would require the removal of the following track bridges:

Mozart Street
Centre Street
Heath Street
New Heath Street
Tremont Street
Station Street
Prentiss Street
Ruggles Street

Construction would proceed from south to north and the structures would be removed in the order given. Transportation of the dismantled structures as well as the rails, ties, ballast and granite blocks could be done by rail.

Following the removal of each structure and adjacent track, etc. the existing embankment would be levelled and additional material brought in when required to construct the area to appropriate finished grade. Sheeting would then be driven on both sides of the rail/transit facility at the proposed location of the back of footing and the section excavated. The depth of the section excavated would be ten to fifteen feet below the elevation of the surrounding area. Suitable excavated material would be used at the site for fill. Unsuitable material would be transported out of the area or used as slope dressing.

As the sheeting operation progresses, existing utility installations, including drainage culverts, would be hung on supports crossing the cut area. Some utilities would require relocating more than once as phasing of the excavating operation would dictate. The major utility in the Corridor is the Stony Brook Culvert. Where required, utilities which are to be placed in an inverted syphon would be constructed at this time. Construction of the walls for the rail/transit section would follow the excavation and utility relocation.

The local cross streets would be worked on concurrently, but would be restricted to a very precise timetable dictated by the maintenance of local traffic. In many cases the local streets would need to be reconstructed for a length of two to three hundred feet on either side of the tracks with fills in excess of fifteen feet. This type of construction precludes temporary roadways or stage construction of the local street and requires a long term closing of the street. Therefore, adjacent cross streets could not be worked on concurrently.

Local street bridges to be constructed under this contract would be:

Boylston Street
Mozart Street
Centre Street
Heath Street
Cedar Street
Tremont Street
Ruggles Street

Track work, the work on the passenger stations, arterial road, power signals and communications would be initiated as the work becomes feasible relative to the completion of significant lengths of the rail/transit section.

As the need for access to the construction site decreases, landscaping and noise attenuating measures would get underway with the final fencing being installed to insure safety and secure the site.

5.2.2.6 Contract #3 Depressed - Mozart Street to Forest Hills - Rail Service Discontinued During Construction

Reconstruction of the rail roadbed in a depressed section would require the building of new bridges over the right-of-way for local street circulation and accessibility to the proposed transit stations. New bridges will be constructed at the following locations:

Boylston Street
Minton Street
Green Street
Gordon Street
Williams Street
McBride Street
Morton Street
Washington Street
Paul Gore Street

In addition, a pedestrian overpass would be built at Oakdale Street crossing both the tracks and the proposed arterial street.

As in the previous depressed section, the width of the depressed "boat section" between interior wall faces runs from a minimum of 72 feet for the standard tangent section to 100 feet in width at the typical transi station.

Again, the depth of depression will be approximately 25 feet with variations as set forth in 5.2.2.3.1.

Utility services will be intercepted and handled as in the previous depressed section. However, in this section Stony Brook Culvert is sufficiently removed from the construction site so that relocation of this major facility is not necessary. However, in coming out of the depression south of Forest Hills Station, Stony Brook is once again encountered. To overcome impacting this large facility, the grade of the depression through Forest Hills Station was raised sufficiently to allow a track grade which could overpass the culvert. The raising of the grade at Forest Hills Station also permitted laying out a local street pattern which provided better movement for station access and egress.

5.2.2.6.1 Construction Methods

The Line Segment from Mozart Street to Forest Hills would require construction procedures identical to those for the Line Segment from Camdem Street to Mozart Street (see Section 5.2.3.1).

5.2.2.7 Contract #3 Elevated - Mozart Street to Forest Hills - Rail Service Discontinued during Construction

Reconstruction of the railroad embankment to accommodate a new 5 track system in this contract will require the demolition of all existing and construction of new bridges at the following sites:

Paul Gore Street
Boylston Street
Minton Street
Green Street
Gordon Street
Williams Street
McBridge Street
Morton Street
Washington Street

5.2.2.7.1 Construction Methods

The conditions and construction procedures as outlined under Elevated Contract #2, Camden Street to Mozart Street (section 5.2.2.4.1), apply here equally as well since both contracts are similar in scope and content.

5.2.2.8 Contract #3 Modified Depressed - Mozart Street to Forest Hills - Rail Service Discontinued during Construction

Construction of the Modified Depressed alternative within the contract #3 limits would require the removal of the track bridge at the following locations:

Boylston Street
Green Street
Williams Street
McBride Street
Morton Street

Following the removal of the existing structures, the existing embankment would be reconstructed to the proposed design grades and sheeting would be driven for the proposed footings of the rail/transit walled section. The area within the sheeting would be excavated, the walls formed and the concrete placed. As the section proceeds local street bridges proposed to cross the rail/transit facility would be constructed. The structure would be located at:

Boylston Street
Minton Street
Green Street
Gordon Street
Williams Street
McBridge Street
Morton Street

Utility service interrupted would be handled as described in previous depressed sections.

5.2.2.8.1 Construction Methods

The Line Segment from Mozart Street to Forest Hills would require construction procedures identical to those for the Line Segment from Camden Street to Mozart Street (see Section 5.2.2.5.1)

5.2.2.9 Contract #4 Arterial Street - Ruggles Street to Forest Hills

5.2.2.9.1 - Segment #2

To construct this segment the first phase could be to build a detour road which would replace the streets taken out of service while the Arterial Street was being constructed. It would be 4 lanes wide with connections at all cross streets now intersected with Columbus Avenue. When constructed, traffic would be transferred from Columbus Avenue to the detour road.

All existing pavement, curbing, foundations and any unsuitable material between the detour road and Penn Central right-of-way, within the limits of Segment #2 would be excavated and removed from the job site.

The entire area within the described limits would be constructed to its final grade with the exception of the arterial street which would be constructed to the subgrade.

All utilities would be relocated and connections made to those previously relocated under the rail/transit facility construction contract. In the event the arterial street preceeded the rail/transit facility provisions would be made for the future connection. Catch basins, man holes and all roadway drainage pipes would be laid. During this phase of the operation all cross streets would remain open to traffic after the sub-base has been placed and a temporary pavement laid.

As each cross street was reached, the cross street would be closed to traffic, the temporary pavement excavated and the permanent pavement laid with the joining of pavements done in conformance with accepted practices.

As the pavement phase is completed, street lighting, signalization and signs would be installed followed by the construction of the sidewalks and the landscaping of the area between the arterial street and the rail/transit facility. The new street would then be opened to traffic.

The detour road would be excavated, the cross streets reconstructed and the area from the arterial street to the taking lines would be landscaped.

5.2.2.9.2 Segment #3 - Centre Street to Forest Hills

There were two design alternatives developed for this segment, the first being an alignment completely on the easterly side of the rail/transit facility from Centre Street to Forest Hills. The second aligned on the easterly side of the rail/transit facility and would be located on the westerly side of the tracks to a point approximately 600 feet north of Morton Street where it would cross under the tracks to become aligned with Hyde Park Avenue at Morton Street.

There would be no detour road built in conjunction with segment three of the arterial street because no major street is being closed to traffic during the construction phase.

Arterial Street East

The construction of Segment #3 would involve the demolition of all buildings scheduled to be removed under the Arterial Street East alternative (FH-4). Following the demolition of the necessary buildings, modifications to the local streets would be made which include:

- The excavation of Lamartine Street in segments. Utilities would be removed or rerouted as required.

- The excavation of Oakdale Street from Green Street to a point 250 feet north of Green Street. A 90-foot diameter cul-de-sac would be constructed on Oakdale Street approximately 250 feet north of Green Street.

- The excavation of Bishop Street from Everett Street to the Penn Central right-of way.

The local cross streets would be rebuilt from the rail/transit facility through the intersection location to meet existing grade east of the proposed arterial street. Utilities within the cross streets would be relocated and adjusted during the reconstruction.

All utilities, drainage structures and pipes would be installed. The area within the taking lines and the rail/transit facility would be landscaped. The arterial street would be interfaced with the cross streets, the connection with Centre Street and Morton Street made, pavement markings applied, lighting, signalization and signing installed and the facility opened to traffic.

Arterial Street West

The construction of Segment #3 - Arterial Street West, by necessity, would have to follow the construction of the rail/transit facility.

The first phase of the construction of Segment #3 would involve the demolition of all buildings scheduled to be removed under the Arterial Street West alternative (FH-4). Following the demolition of the necessary buildings, modifications to the local streets would be made which include:

- The excavation of Lamartine Street in segments. Utilities would be removed or rerouted as required.

- The excavation of Ballin Terrace. Utilities would be removed or rerouted as required.

- The excavation of Lawndale Terrace from the existing railroad embankment to a point 100 feet east of Lamartine Street.

- The excavation of Lamartine Place from the existing railroad embankment to a point 200 feet east of Lamartine Street. A connecting street could be constructed between Lamartine Place and Oakdale Street approximately 150 feet west of the existing Penn Central railroad.

- The excavation of Oakdale Street between Green Street and a point approximately 250 feet north of Green Street. At that point a 100 foot diameter cul-de-sac would be constructed. All utilities would be removed and rerouted as required.

- The excavation of Call Street from Green Street to Everett Street along with the removal and rerouting of utilities as required.

- The excavation of Call Street from Hall Street to McBride Street. The utilities would be removed and rerouted as required. An improved connection would be constructed between McBride Street and Call Street and a replacement connection would be constructed between Hall Street and Boynton Street approximately 50 feet west of the existing Call Street.

Local streets which cross under the proposed rail/transit facility would be reconstructed to the final line and grade. All utilities would be adjusted as required. The final pavement would be placed with provisions for a stub connection to the Arterial Street. The cross streets would be open for traffic. The streets included are Mozart Street, Boylston Street, Minton Street, Green Street, Williams Street and McBride Street.

The section between Jackson Square to Marbury Terrace from the rail/transit facility to the limit of the takings would be cleared.

The Arterial Street would be constructed to the line and grade of the sub-grade and the remainder of the area within the project limits constructed to final grade.

The utilities and drainage pipes would be installed, catch basins and manholes constructed and the necessary connections to existing drainage systems and utilities made. Connections would be made to Mozart Street and Marbury Terrace, but the Arterial Street would not be open to traffic at this stage.

Proceeding south, the section from where the Arterial crosses beneath the rail/transit facility at Marbury Terrace to where it recrosses north of Forest Hills would be constructed.

The Arterial Street would be constructed to the line and grade of the sub-grade and compacted to the prescribed density. The utilities and drainage pipes would be installed, catch basins and manholes constructed and the required connections to existing drainage systems and utilities made. The connections to the cross streets would be made but the Arterial Street would not be open to traffic.

Morton Street relocation would be essential to the opening of the Arterial Street to traffic. Construction of Morton Street could be done at any stage of the project as it is independent of the other phases of this project. Morton Street West would be closed to traffic, the existing pavement excavated, and the utilities and drainage structures relocated or rebuilt as required.

The section of the Arterial Street between the undercrossing of the rail/transit facility and Morton Street is a short section, which includes a connection to Washington Street. The area would be cleared, and the arterial constructed. Utilities and drainage pipes would be installed, catch basins and manholes constructed, curbing set, and the gravel sub-base placed.

The area designated for landscaping within the taking lines for the entire length of the Arterial Street would be landscaped and the facility opened for traffic.

5.2.2.10 Contract #5 - Trackwork - South Cove to Forest Hills

Trackwork could be considered in one segment (Contract 5) from north of Berkeley Street to a connection with existing Penn Central tracks immediately to the south of Forest Hills. It is considered advisable, in order to expedite completion, that the work should be done under two separate contracts (Contract 5a and Contract 5b), one for railroad, the other for the relocated Orange Line.

Spreading of ballast, distribution of ties and laying of rails would proceed from south to north in order to allow uninterrupted delivery of welded rail strings 1500 feet long. It is not feasible to deliver from the north because there would be trackwork and civil construction in the Berkeley Street/Dartmouth Street area. In addition, there would be interference with rail traffic on the Boston and Albany and Penn Central lines between Back Bay, the Penn Central yard and Boston's South Station.

Rail welding into strings, joint grinding and weld testing could be performed off the project site at a location selected by the construction contractor and approved by the MBTA. Undrilled 115 pound RE rail would be used for transit and undrilled 132 pound RE rail would be used for railroad installations. An established welding plant would be desirable from an expertise standpoint; however, a portable plant could be sufficiently productive and possibly more efficient in making deliveries as required.

After welding, each joint would be ground to assure a true section and acceptable riding qualities. The rail strings would then be loaded on a rail train for delivery to the site. A rail train is composed of several tiers of supports mounted on flatcars which have been connected to form the rail train capable of taking many strings. The majority of the strings would be produced 1500 feet long. Some strings would be made to shorter lengths for connection to crossovers and insulated joints at impedence bonds.

Ballast would have been spread and ties placed an optimum distance ahead prior to rail delivery. Grade would be kept low so that completed track would be raised to exact profile grade during ballasting operations.

Upon delivery, strings would be "snaked" forward from the rail train, set in position and fastened to the ties sufficiently to let the train proceed on the track for the delivery of strings ahead. Between rail train operations, rail would be fastened permanently and rough ballasting performed. When one track would have proceeded a suitable distance, rail would be delivered for the second or third tracks. The train rail would move forward as far as possible on the completed track, rail strings would be anchored and the train backed out from under them.

Continuous strings would be field welded on the site, all rail clipped to the ties to control expansion and crossover installation and ballasting completed.

A choice of ties is possible. Wood ties have been used from early times and have given good service. Cresoted timber ties, though generally difficult to obtain in quantity, can be expected to have a minimum life expectancy of 25 years in transit service. Precast concrete ties would be readily obtainable. They would be heavier than wood and would offer greater resistance to rail stress. They could be spaced further apart than wood ties. Concrete ties would have a mugh higher life expectancy in transit service. However, concrete ties would allow current leakage sufficent to preclude the use of certain train control and cab signal circuits. This could be overcome successfully by introducing insulated track-mounting hardware.

The addition of resilient rail fasteners in the form of a neoprene pad between the rail and the tie or concrete tunnel invert will reduce vibration levels on the order of 5-10 dB compared to direct fixation. While this is an effective means of vibration control, it will not reduce noise.

There should be no difference in track-installation techniques should the track be on an embankment or in an open cut or depressed section. In any of these cases, there would be no operating railroad at approximately the same grade from which rail strings could be unloaded along the site expeditiously.

An alternative studied between the portal of the South Cove tunnel and the vicinity of Massachusetts Avenue places the transit tracks in a tunnel (see Section 4.4). In this area, the rail could be directly bolted to the concrete deck. Bolting to the deck would require insulation because of excessive current leakage which interferes with the track-signal system.

5.2.2.11 Contract #6 - Power Supply and Distribution (MBTA)

For the purposes of the impact analyses, two types of traction power were studied, Overhead Catenary System and Third Rail System. With either system, the traction power supply would have a voltage range of 450-690 volts dc. Under Contract #6, power, equipment and facilities would be installed as determined in final design.

Overhead Catenary System

The intercity rail (AMTRAK) and the Federal Railroad Administration (FRA) are required to provide an electrified overhead catenary system as part of the New England Corridor Project. The catenary supports for AMTRAK could be also used by MBTA Orange Line.

For the catenary alternative with depressed tracks, catenary wires would be supported from the boat section walls. Where the walls were lower than the required wire elevation, stub poles would be bolted to the top of the wall. Poles could also be installed from within the limits of the boat section walls. This support system, though feasible, is less desirable since it generally reduces side-clearance dimensions.

For the elevated-track alternative, catenary wires would be supported by steel-cantilever brackets mounted on reinforced-concrete foundations.

Supports would be spaced approximately 100-200 feet apart. The conductors would have feed ends spaced approximately one mile apart, at which point strain insulators would be installed. One feeder would be tied to the catenary at each pole.

Third-Rail System

To be compatible with the present operating Orange Line, the installation of a third-rail power system would be desirable. Such a system would eliminate the need for retro-fitting pantographs to the present rolling stock. Cost comparisons for the basic power system (substations not included) indicate that the capital cost for third-rail is approximately 15 percent less than that for catenary.

For safety reasons, in all alternatives, the right-of-way would be fenced. In addition, the catenary wires would be shielded in specific areas in order to protect against inadvertant contact.

5.2.2.12 Contract #7 - Signal and Communication Systems

The installation of the signal and communication systems for the railroad facility would be done under Contract #7a. Equivalent work for the Relocated Orange Line would be done under Contract #7b.

Under either the track-depressed or track-elevated alternative, identical signal and communication systems would be installed. Under the depressed alternative, conduits for signals and communications would be hung on the walls of the boat section. Provisions would be made for connections to wayside signals, switch interlocks and trips, and to impedance bonds. For the track-elevated alternatives, signal and communication wiring would be in a duct bank along the right-of-way with manhole pullboxes spaced approximately every 500 feet. Connections to wayside trip catenary supports would be made for connection to wayside signals. Signal display mounts would be installed at locations selected during final design. Conduit would be provided for extending circuits to passenger stations, consoles and electric substations.

5.2.2.13 Contract #8 - Passenger Stations

5.2.2.13.1 General

Three basic construction contracts are anticipated for the following stations:

8a and 8b Back Bay, Massachusetts Avenue
8c and 8d Jackson Square/Roxbury Crossing, Ruggles Street
8d and 8f Boylston Street/Green Street, Forest Hills.

Station buildings for Massachusetts Avenue, Boylston Street, and Green Street are considered prototypical for design and construction purposes. Their construction would most likely be similar, consisting primarily of reinforced concrete. Precast floor, roofs and platform canopies would provide attractrive cost efficient construction. Although architectural treatments would vary with each station, maximum use would be made of materials proven most effective for station finish. Where required, surfaces which are mark resistant, skid resistant, light transmitting or sound deadening would be utilized to minimize problems of safety, maintenance or station environment. Station graphics and components would be in accordance with MBTA standards.

No station building would be materially affected by decisions which relate to the construction of the arterial street. Station access and construction of external circulation systems, however, are generally less integrated into the roadway network without the arterial street.

Under the depressed-track alternatives, the buildings would be constructed on girders crossing the boat section. The girder bridge seats would be incorporated into the walls of the boat section. The decks for the buildings could be provided by prestressed, precast "T" girders or a reinforced slab resting on beams / box beams or composite sections. The passenger platforms would be constructed on the deck of the boat section, being tied in by reinforcing bars protruding from the boat section for that purpose.

If the tracks are to be located on an elevated structure, the passenger building could be constructed on conventional footings, as determined by soil conditions.

The overhead platforms could be supported on a girder system designed to support the transit and railroad loadings. Girder construction would likely be of steel, prestressed concrete or composit beams. Use of an open-truss system between adjacent streets would provide natural lighting and give better opportunity for surveillance of the station area.

The Ruggles Street/Northeastern Station would be designed to allow transfer between the Orange Line and commuter rail with future provisions for crosstown transit. For this reason, the configuration of the facility would differ markedly from that of the stations described above. The addition of the commuter-rail platforms increases the overall width at the station area to approximately 177 feet. This is an increase of about 77 feet in width over the protypical stations.

As Contract #3 proceeds southward from Mozart Street, first Boylston Street then Green Street would be scheduled for construction, both prior to Forest Hills. Jackson Square and Roxbury Crossing stations would follow shortly as Contract #2 proceed northward from Mozart Street. These would be completed before Forest Hills and Ruggles Street/Northeastern.

5.2.2.13.2 Forest Hills Station

The Forest Hills passenger station for depressed alternatives would be constructed at the approximate ground elevation of Hyde Park Avenue. The basic concept of the station building would be the same regardless of whether the tracks were elevated or depressed.

Once the mainline track work gets underway, it will be necessary to terminate Orange Line service at a point north of the present Forest Hills Station complex so that an open, unimpeded work area will be available for new-station construction.

A temporary station could be constructed around the existing elevated track system in Washington Street. The northerly end of a new station would be approximately 750 feet north of the present Forest Hills station and adjacent to existing MBTA bus and Green Line terminal property. This location provides sufficient room for a temporary station with adequate patron access and egress. South of the temporary station location, sufficient elevated track could remain in service to provide a train turn-back. This entire temporary operation could be accomplished between the present Forest Hills Station and the proposed temporary station location. With the exception of new switches, no additional new track would be required. The remaining existing elevated track through Forest Hills Station could be removed to permit complete construction of the new Orange Line Terminal.

Once the existing elevated structure has been removed from the new station work area, the main track envelope could be completed and first-level construction of station and commercial space adjacent to Hyde Park Avenue could begin. The next stage would be the second level of construction for the proposed bus concourse adjacent to Hyde Park Avenue. Simultaneously, construction on the west side of the proposed station adjacent to Washington Street could be undertaken to accommodate the new Green Line trolley station.

Once the major heavy station construction at ground level is basically completed, work could proceed on the parking deck over the station-busway complex. Concurrently the reconstruction of Hyde Park Avenue, Washington Street and required bridge structures could be completed to provide a totally functional operating transportation terminal.

At all times during the construction of the Forest Hills Station complex, the travelling public will have vehicle access through the existing street pattern or by means of temporary adjacent detours.

The Forest Hills Station would be dependent upon the completion of Contract #3 (Mozart Street to Forest Hills). Since Contract #3 would proceed from north (Mozart Street) to the south in order to maintain railroad service for the disposal of excavation, Forest Hills would follow Boylston Street and Green Street in construction sequence. It would preceed Ruggles Street, Massachusetts Avenue and Back Bay.

5.2.2.13.3 Green Street Station, Boylston Street Station Jackson Square Station, Roxbury Crossing Station, Ruggles Street/Northeastern Station

The layout of these stations would be virtually the same, some modification being required to meet access from adjacent streets.

Ruggles Street/Northeastern Station would be the last station scheduled within the limits of Contract #2 (Camden to Mozart Street). It would follow Jackson Square and Roxbury Crossing station, but run concurrently with much of Roxbury Crossing construction. It would be scheduled ahead of Massachusetts Avenue to the north.

5.2.2.13.4 Massachusetts Avenue Station

The general configuration of this station would be similar to Green Street, Boylston Street, Jackson Square and Roxbury Crossing.

The Massachusetts Avenue Passenger Station would be supported by girders and columns over the proposed transit tracks which are depressed below street grade. The transit and railroad tracks would be approximately two feet lower than existing Penn Central track grade. The lower track grade has no effect upon station construction. The station platforms could be supported on a concrete foundation furnished under a previous Contract #1. The station building would probably be constructed of reinforced and precast-concrete.

Since the station would be located within the limits of Contract #1, which follows both Contracts #2 and #3 in construction timing, it is the final station to be scheduled for completion. It would follow all stations to the south, concurrently with the proposed station at Back Bay to the north.

5.2.2.13.5 Back Bay Station

Station construction for Back Bay was analyzed for two alternatives. Alternative SC-1 provides for all track passing the station to be approximately in the same grade. Alternative SC-2 places the transit below the railroad facility.

The construction of the Back Bay Station under Alternative SC-1 requires acquisition of land along the south right-of-way line of the existing Penn Central trackage. These acquisitions are required to accommodate two Boston & Albany tracks, 3 Amtrak tracks and two tracks for the Orange Line together with their respective passenger platforms.

The first step would be to reconstruct the retaining walls at the relocated southern right-of-way line, together with the street crossing bridges and viaducts. The three tracks closest to the southern right-of-way will be used for railroad operations. These tracks will be depressed about four feet below their current elevation throughout the station.

In Alternative SC-1, there will be a railroad side platform closest to the relocated and widened southern right-of-way line. This platform and part of the slab protecting the adjacent track against uplift will be combined with a vertical stem to form a cantilevered retaining wall (from the eastern end of the platform to a point adjacent to the Heath Building on the west side of Clarendon Street). Construction of this segment can proceed behind a protected cut braced by a system of tight sheet piles and walers which can be tied back or strutted into the right-of-way area.

Opposite the Heath Building the needed right-of-way space butts up directly against the basement wall of the building. Because of space limitations, this basement wall could be utilized as a part of the railroad platform side wall. The Heath Building is founded well below the anticipated level of station construction on footed caisson-type piles. The basement level of the building is about 12 feet above the excavation subgrade of the adjacent railroad foundation slab. This difference in elevation will require the construction of a 15 to 20 foot deep cut-off wall directly under the presently existing Heath Building basement wall. To accomplish this, the basement wall could be exposed, and demolished approximately 10 feet above basement level. A slurry trench cut-off wall would be built in sections between the existing foundation caissons to the required depth. The slurry wall will be reinforced and tied into the existing basement slab. The removed part of the Heath Building basement wall will be rebuilt after completion of the slurry cut-off wall.

The adjacent National Garage structure columns will be underpinned down to a level below the expected zone of settlement influence before excavation of Buckingham Street proceeds behind a tightly sheeted and braced or tied-back support system. In this area, the railroad platform will be combined with a cantilever stem to form the permanent retaining wall system. West of the end of the southern railroad platform, the existing masonry retaining wall and the abutment of the Dartmouth Street viaduct can

remain in place since track-layout geometry does not require their removal. The Dartmouth Street viaduct will have to be rebuilt since the existing supporting columns are not compatible with the location of the new tackage.

Buckingham Street will be decked over in those parts which overlie the new Back Bay station. Utilities which lie in the bed of Buckingham Street between Dartmouth Street and Clarendon Street, Buckingham Street and the Hancock Garage will be decked over and supported on columns located between tracks, or on station platforms. A new line of deck support columns will be located adjacent to the Hancock Garage footings.

The three railroad tracks have been depressed by 5 feet as compared to the Orange Line and Boston & Albany tracks throughout the station. The depressed tracks would likely be founded on a concrete slab to protect them from up-lift pressures caused by high water table levels.

The existing Back Bay station superstructure and parking deck will be demolished down to existing track level. Limited use of the station is possible during reconstruction operations. The street viaducts at Berkeley, Clarendon, Cazenova, Columbus and Dartmouth Streets will be rebuilt in conjunction with the construction of the new south right-of-way line retaining wall. Traffic detours will be necessary and will be developed to minimize the impact of reconstructing these facilities. Arlington Street/Tremont Street will be reconstructed as part of the South Cove Tunnel Extension Project.

The construction of the Back Bay Station under Alternative SC-2 requires the rebuilding of the south right-of-way line retaining wall system to make room for the south railroad platform. However, less shifting of the right-of-way line is required in this scheme than under Alternative SC-1.

In this scheme the Orange Line tracks would be in a twin-concrete box below the existing trackage. In the vicinity of the Back Bay Station the two southerly railroad tracks would be placed directly over the Orange Line thus allowing the respective station platforms also to be placed over each other. The transit station is of the side platform type. The top slab of the twin-box Orange Line structure will be reinforced to accept the superimposed loads of the railroad service.

Construction would first proceed by building the proposed twin-box structure for the transit line in a tightly sheeted and crossbraced retaining structure. In order that ground-water levels might be maintained at near-normal levels, excavation between sheet pile walls will be excavated in the wet, and a substantial bottom tremie concrete seal will be placed. After the slab has set the excavation can be pumped out and cross-braced at appropriate levels. Construction of the twin-box structure can now proceed on top of the tremie seal.

After completion of the box structure the excavated ground would be back filled. The structure would then be ready to support the railroad facility loadings. All construction would be coordinated with the reconstruction of the street/viaduct crossings and new viaduct supports will be integrated with the twin-box structure.

After completion of the Orange Line twin-box and station structure, the south right-of-way line retaining wall can be rebuilt to accommodate the new south railroad platform. The new retaining wall from the east end of the platform to the eastern

end of the Orange Line station structure combines a vertical cantilevered retaining wall stem with the railroad platform which serves as the base of the retaining wall.

Footings of the Heath Building consists of large diameter bellied caisson piles founded approximately at the level of the bottom of the tremie concrete base slab of the Orange Line Station structure. The adjacent garage, to the west of the Heath Building will probably require underpinning work on those column footings closest to Buckingham Street, especially the easterly ones which lie closer to the relocated south right-of-way line. Construction of the new south right-of-way retaining wall and street viaduct system will proceed behind a tightly sheeted and braced temporary support system. The bracing could consist of a tie-back system, or of the raker type braced against the existing Orange Line twin-box structure.

At the western end of station, the transit and railroad platforms end at the same point. From this point on, the existing retaining wall may be left in place, modified only to support the proposed decking over the Back Bay Station which would extend from Dartmouth Street to Clarendon Street and from Buckingham Street to the Hancock Garage. Buckingham Street would be relocated in the vicinity of Clarendon Street to permit incorporation of drop-off lanes and street access from the platforms below. The south abutment of Dartmouth Street would also remain in place, but the viaduct itself will have to be rebuilt to accommodate new support locations which are dictated by the proposed track layouts.

The existing Back Bay Station will be demolished down to existing track level together with the parking deck to the east of it. Limited passenger service can probably be maintained during reconstruction of the facility. The reconstruction of the viaducts over the trackage at Berkeley, Cazenova, Columbus, Clarendon and Dartmouth Streets will be scheduled to cause a minimum of disturbance to existing traffic patterns. The utilities in Buckingham Street will have to be relocated or maintained in place and provisions will be made to allow at least one traffic lane to remain in service during construction. Arlington/Tremont Street will be reconstructed as part of the South Cove Tunnel Extension Project.

The Back Bay Station could be scheduled substantially prior to Massachusetts Avenue Station to the south. Because of its complexity, considerable time would be allowed. Completion would be concurrent with the completion of the Massachusetts Avenue Station.

5.2.2.14 Contract #9 - Demolition of the Washington Street Elevated Structure

The demolition of the existing Washington Street "El" would occur in two separate phases. The first section would be demolished from the south end of Dudley Station to the terminus at Forest Hills. The second section to be demolished would be between the south portal of the tunnel (about 800' north of Massachusetts Avenue) to and including Dudley Station. Demolition would not occur prior to the completion of the relocation of the Orange Line to the Penn Central alignment though the existing station at Forest Hills will be demolished and replaced with a temporary station in order to facilitate construction of the Southwest Corridor Project. The demolition contract would provide for the complete demolition of the entire structure six inches below the existing street pavement or sidewalk with necessary patching of same. The removal of all materials and debris from the site is also included.

The riveted structure has considerable section loss in many members, and, therefore offers little in the way of re-use as structural steel. It is anticipated that after removal of rail,ties and signals, the major longitudinal members will be cut free at the bents, loaded onto flatbed trucks with a crane and removed from the site.

The cutting of steel members will likely be accomplished by means of oxy-acetylene torch. As a result, hot metal beads would be dropped in the travelled way of Washington Street. A crane will be needed on Washington Street equipped with slings to hold the members being removed and to transfer these onto flatbed trucks.

These procedures will require periods of one-way traffic on short sections of Washington Street during some of the more minor demolition operations. Traffic police and barricades will be necessary to accomplish this. However, during the period when the main longitudinal structural members are being cut out and lowered to trucks in the narrow portions of Washington Street, the complete closing of a block-long section for a very short time may be required for safety. Obviously, detours will be necessary to accomplish this.

Refer to Section 5.8 for a more complete discussion of the construction process for removal of the Washington Street Elevated and of the Replacement Service provisions that will be made.

5.2.3 Construction Duration (Fig. V-13)

The scheduled project construction duration has been drawn in order to minimize project construction time while still providing environmental benefit. Meeting the shortest schedule for any alternative requires the detour of railroad operations to the Midland Division during the Southwest Corridor project construction period in order to avoid delays in construction owing to the presence of rail traffic on the Shore Line. These delays could extend the construction period by 15 months. The retention of the existing embankment could shorten construction time by one year, but would involve environmental impacts found unacceptable to the City of Boston and the residents of the Corridor neighborhoods (see testimony offered at the Public Hearing).

Any delay in construction could undoubtedly cause further deterioration in Corridor neighborhoods due to the presence of unutilized and blighted lands cleared for Interstate 95. Property values could continue to decline because of the inability to sell structures located near the Corridor.

The prolonging of construction would add to the cost of construction at the rate of approximately 10 percent per year of delay. This is estimated to amount to approximatley $40 million per year, for each year beyond 1982 in which the project was delayed to completion.

At the Southwest Corridor Public Hearing several participants expressed the feeling that the project should be constructed as quickly as possible to prevent further blighting deterioration upon Boston neighborhoods and inflationary expense in construction of the project.

Obviously, the calendar time of awarding a major civil contract will have an influence on the contract duration. A mid-winter start-up will not be as expeditious as a start-up in the warmer months. However, for construction duration purposes it has been assumed that all operations (except landscaping), particularly concrete work, will continue for all months of the year.

South Cove to Forest Hills -
Depressed or Modified Depressed Rail/Transit with Arterial Street

The presumption here is made that all rail traffic has been temporarily relocated to the upgraded Midland Branch to provide an unobstructed right-of-way for construction. Under such conditions, and assuming the project to be structured into 3 major civil contracts, the anticipated total construction duration would be approximately 3 years and 9 months. However, if rail traffic is not diverted to the Midland Branch, but is to be maintained in the Corridor, and serve Back Bay Station, a temporary rail system could be provided to permit

construction of the new rail/transit facility. This temporary system would be in the form of a 2-track railroad trestle from Forest Hills to just north of Ruggles Street. The construction of such an extensive trestle will require a lead time of 12 to 15 months resulting in a total contract duration of 5 years, and was therefore rejected.

Rail/Transit on Modified Embankment with Arterial Street

It is again presumed here that all rail traffic will have been temporarily relocated to the upgraded Midland Branch to provide an unobstructed work area. Under these conditions, the reconstruction of the present railroad embankment to a new five track system will result in a construction duration of approximately 2 years and 6 months.

Two options for construction were evaluated if rail service were to have been maintained on the Shore Line and serve Back Bay Station directly, namely, reconstruction the embankment one-half at a time or the temporary trestle system. Reconstructing the embankment one-half at a time while maintaining rail service on two adjacent tracks was considered unacceptable and hazardous leaving only the temporary trestle option. As in the depressed scheme, this trestle would require a lead time of 12-15 months extending the construction duration for this option to approximatley 3 years 9 months. This option is described in detail in Section 4.5.7 of this Impact Statement. Further, it was discussed and rejected at several public meetings with commuter rail riders who had no interest in the travel time delays that would accompany this method of providing service. Futhermore, residents of the project area rejected the alternative because it would seemingly prolong the construction period.

Depressed or Modified Depressed Rail/Transit without Arterial Street - Rail/Transit on Modified Embankment without Arterial Street

The dominant construction undertaking is the construction of the rail/transit facility, be it on a modified embankment, depressed, or modified depressed. The rail/transit facility sets the pace and determines the overall schedule.

The Arterial Street, though a relatively important undertaking can be constructed in its entirety concurrently and totally within the scheduled time for the rail/transit facility. For this reason, the construction duration without the Arterial Street will not increase or decrease the scheduled times.

The scheduled construction durations are based on working a single day shift only. The maximum shift permitted would be from 7:00 am to 7:00 pm. Work prior to or after these hours would be permitted for demonstrated emergency purposes only. A failure to meet scheduled mile posts would not be considered an emergency.

5.2.4 Construction Costs (Fig. V-14)

Existing data provided the basis for development of alignment plans and working cross-sections from which all quantities were estimated for pricing. The estimated quantities contain sufficient work-item breakdown (e.g. excavation, embankment, concrete, bridges, walls, transit and railroad track, signals and communications, transit power, completely operational transit and railroad stations, noise attenuating devices, arterial street paving, cúrb, sidewalks, bicycle paths, street lighting, traffic signals, roadside beautification, utility, relocations, project fencing, maintenance and protection of traffic) to generate an estimated cost of sufficient detail, depth and accuracy.

The unit prices, applied to the estimated quantities, are a reflection of the latest bidding on similar types of construction in this general geographic area. The unit prices further reflect the intricacies and complexities of this project.

All estimated costs are expressed in 1976 dollars and no provisions are made for future escalation. The total construction costs do, however, contain a thirty-percent (30%) add-on to cover contingencies and engineering.

Property-acquisition costs are not included in the cost estimates. Costs for the relocation of public utilities such as water, sewer and storm drains are included in the estimates, However, relocation costs for private utilities such as gas, telephone and electric power have not been included in the estimates.

Acquisition and relocation costs for the alternatives were estimated on the basis of average property values and relocation costs for families and businesses as part of a "conceptual stage relocation plan". These costs are as follows:

LAND ACQUISITION AND RELOCATION COSTS (in thousands)

	SC-1 + FH-1	SC-1 + FH-2	SC-1 + FH-3	SC-1 + FH-4	PHP-2 or SC-1 + FH-5	PHP-1 or SC-1 + FH-6
R-O-W	3,000	3,400	2,800	3,800	4,600	4,500
Land Damages	2,500	3,000	2,500	3,200	4,500	4,000
Relocation	800	1,000	800	1,000	1,500	1,400
Total	6,300	7,400	6,100	8,000	10,600	9,900

5.2.5 Construction Impacts

5.2.5.1 Movements of Materials and Equipment

The impacts upon the project area due to the movement of materials and equipment would be diverse in severity and duration. By following an outline of the construction phasing the impacts can be predicted.

In order to facilitate the readers understanding of what is being compared, the project has been divided into two sections. One section would be from South Cove to Camden Street designated SC and the other, Camden Street to Forest Hills designated FH.

A major impact on the entire project site will be caused by the number of workers going to and from the job site and the parking required in the immediate area. In areas south of Ruggles Street where clearance is extensive, parking will be easily accommodated.

Alternative SC-1 South Cove to Camden Street with Minimum Grade Adjustment to all Tracks

Local Streets which now bridge over the railroad right-of-way between South Cove and Camden Street would be replaced due to new rail/transit width requirements (Dartmouth Street, Berkeley Street, Clarendon Street, Columbus Avenue, Massachusetts Avenue and West Newton Street, and would be reconstructed while the rail line was still in service. Steel members for these structures would be shipped by rail to the site but all other materials would be transported by truck on local streets.

Materials for the drainage within the rail/transit facility would be trucked over local streets as would the power and signal system equipment.

The materials needed to lay the tracks would be brought in by rail. Stock would be piled in lands that are currently cleared and owned by MBTA and DPW. They would include ballast, ties and the 1,500 foot sections of welded rail. The transportation of the material would not have a significant effect on the rail/transit corridor - as there would be no regularly scheduled traffic in the rail corridor at that time.

Alternative FH-1 Depressed Section without Arterial Street

In order to construct this alternative, the existing embankment between Camden Street and Forest Hills would need to be removed and the proposed 3.2 mile long depressed section excavated. The removal from the project site of the resultant spoil would be accomplished by utilizing the existing rail facilities. At a location midway between Camden Street and Forest Hills, removal of the embankment would begin. The tracks would be removed for a short section and as the embankment was removed it would be loaded onto gondola cars and transported by rail out of the area. After the initial delivery of earth moving equipment into the job area via local streets, the impact of this phase of the operation would be limited to the noise and air pollution impacts associated with that movement.

Much material and equipment would be delivered to the job site by rail and distributed along the rail bed as required. However, some items, concrete for example, would be delivered in ready-mix trucks via the Southeast Expressway, Segment# 1 and Columbus Avenue. The impacts brought about by this phase of the operation include the air pollution and noise associated with heavy trucking in addition to short term traffic congestion and the physical damage done to surfaces of the local streets.

Removal of the existing structures over the local streets would be done as the embankment removal progressed. The steel girders, ties, granite block abutments and walls would be transported out of the area via rail with its accompanying adverse impacts.

Following the construction of the depressed section, bridges would be constructed at the location where local streets previously crossed under the embankment section. The materials needed for these structures; steel, concrete, bridge railings, fencing, etc., would be delivered via local streets with the previously mentioned adverse impacts. Heavy duty cranes would be moved into the project area for setting of the steel members across the depressed section.

Utilities which were located in the local streets beneath the embankment section would, in the future, be carried in the utility bays of the local street bridges over the depressed facility or located beneath the depressed facility. Materials for these relocations would be transported to the project area by truck over local streets.

Stations, which can be constructed independent of the rail, would be constructed following the completion of the depressed section. All the materials used in the construction of the station; concrete, steel, glass, electrical material, plumbing materials, turnstyles, etc., would be delivered by trucks over the local streets.

Alternative FH-2 Depressed Section with Arterial Street

The impacts of the movement of materials and equipment in the project area for Alternative FH-2 will be the same as Alternative FH-1 for the rail/transit facility section. The arterial street, which would be scheduled for construction after the rail/transit facility, would require earth-moving and paving equipment for its construction. It is not anticipated that the arterial street would require great amounts of earth moved in or out of the project site, therefore, after the initial delivery of the heavy equipment to the site, the transporting of the roadway subbase

materials, bituminous material and the landscaping materials will make up the major movement of materials into the area. The impacts will be the air pollution, noise, disruption of traffic and damage to local street surfaces attributed to those movements.

Alternative SC-2 South Cove to Camden Street with Orange Line in Tunnel to Dartmouth Street

Alternative SC-2 would feature a cut and cover tunnel from a point west of Arlington Street to a point west of Dartmouth Street. The remainder of the section to Camden Street is similar to SC-1.

The excavation for the tunnel section would be done in a manner similar to FH-1 and FH-2 with the spoil material transported out by rail. The vast amounts of concrete needed to construct the tunnel would be delivered by ready-mix trucks via the Southwest Expressway, Segment# 1 and Columbus Avenue. The construction impacts would be those associated with a high frequency of trucks moving into and out of the job site.

Alternative FH-3 Embankment Section without Arterial Streets

The major difference between Alternative FH-3 and Alternatives FH-1 and FH-2 is that section between Camden Street and Forest Hills, which will be improved embankment. The existing embankment will be raised and widened, existing bridges removed and replaced, cross streets reconstructed, new rail/transit trackage laid and new stations built under this Alternative.

The construction procedures for Alternatives FH-3 and FH-4 would be very similar to Alternative FH-1 and FH-2. The major difference being the fill being transported into the project area under this Alternative compared to the spoil being transported out under Alternatives FH-1 and FH-2. Impacts will be less severe due to the smaller amount of earth being transported and by the relative lack of concrete needed under Alternative 3.

Alternative FH-4 Embankment Section with Arterial Street

The impacts brought about by the movement of materials and equipment under this Alternative are the same as Alternative FH-3 along with the arterial street impacts from Alternative FH-2.

Alternative FH-5 Modified Depressed Rail/Transit with Arterial Street from Ruggles Street to Forest Hills

Construction of the alternative would require the excavation of significant amounts (1.6 million cubic yards estimated) of material which forms the existing railroad embankment. Of this excavation, approximately 35 percent (.5 million cubic yards) would be transported off the site as unsuitable material. The remaining material (1.1 million cubic yards) would be placed as new embankments where required.

The construction procedures for this alternative are very similar to those of Alternative FH-2. The impacts of the movements of materials and equipment would be similar but less severe than that of Alternative FH-2.

Alternative FH-6 Modified Depressed Rail/Transit with Arterial Street from Ruggles Street to Jackson Square

Construction of this alternative would be similar to that of Alternative FH-5. Under the alternative, however, the arterial street would not be constructed between Jackson Square and Forest Hills. The impacts of the movement of materials and equipment needed to construct this alternative would be slightly less severe as those of Alternative FH-5.

Alternative PHP-1 Post Hearing Rail/Transit Profile with Arterial Street from Ruggles Street to Jackson Square

Construction of this alternative would be similar to that of Alternative FH-6.

Alternative PHP-2 Post Hearing Rail/Transit Profile with Arterial Street from Ruggles Street to Forest Hills

Construction of this alternative would be similar to that of Alternative FH-5.

5.2.5.2 Spoil Disposal

For the Embankment, Depressed and Modified Depressed alternatives, a large amount of debris (concrete from demolished bridges, walls) would need to be disposed of. Additionally, for the fully Depressed Alternative some 3,000,000 cubic yards of dirt, rock and granite blocks would require disposal.

The deposition of this material is discussed more specifically in Section 6.2.2.2.

5.2.5.3 Interruption of Utility Services

The Southwest Corridor alignment from South Cove to Forest Hills is crossed by a number of utility lines such as gas pipes, water pipes, power conduits, telephone ducts, storm drains and sanitary sewer lines. These utilities, with the exception of Stony Brook Conduit, generally cross the Corridor alignment along the present street crossings of the Penn Central railroad.

Among the various rail/transit alternatives considered, the utility lines for the depressed or modified depressed alternatives will be relocated onto structures integral with bridges spanning the cut or would be placed on individual structures as found necessary or desirable in the final design.

The smaller utility lines could cross the depressed alternative in the utility bays of the bridges that would replace the existing street crossings.

Continuity of utility services, during construction of each particular bridge, would be provided by temporarily relocating them in the immediate vicinity.

Storm and sanitary sewers that must cross the depressed alternative would be siphon crossings placed beneath the tracks. Siphons would be multi-barrel type with suitable emergency valves and clean-out chambers to facilitate their proper operations and maintenance. Where it is possible, adjacent storm drains or sanitary sewers would be consolidated or grouped together so that they cross the rail/transit tracks at a single location.

In the "modified embankment" alternative, utility relocations, in general, would be required only where they would interfere with the extension and construction of overpasses and stations. In such cases utility lines would be relocated temporarily to ensure continuity of their services until their permanent relocations are completed.

Reinforcing of some utilities adjacent to the wider embankment would probably be required. Reinforcement of Stony Brook Conduit lying under the proposed Arterial Street may be necessary.

Stony Brook Conduit

The Stony Brook Conduit, which runs along the Corridor, begins in the Hyde Park area and extends through Roslindale, Jamaica Plain, and Roxbury before it outfalls into the Back Bay Fens Pond through the sluice gates at Boston Gate House No. 1, and into the Charles River Basin via the 12' x 12' Foul Flow Channel.

The original purpose of the Stony Brook Conduit, constructed in the 19th Century and partially improved in the early nineteen hundreds, was to contain the Stony Brook flood water and alleviate flooding conditions within the approximately 9,000 acres of the Stony Brook watershed. However, along its entire length, the conduit is connected to a number of existing sanitary sewers including the Stony Brook Valley Sewer, and the West Roxbury Low Level Sewer, thus permitting sanitary sewage to be discharged into the conduit. The conduit is, therefore, considered a combined system conveying both storm and sanitary flows.

The Stony Brook conduit crosses the Southwest Corridor alignment at Forest Hills and Roxbury Crossing area. The Corridor alignment is also crossed by the Old Stony Brook Double Channels at the Ruggles Street crossing.

Forest Hills Crossing. The Conduit at its Forest Hills crossing is an oval shaped, 17'-0" x 13'-9" concrete conduit constructed in 1911. Its invert elevation where it presently crosses the Corridor alignment is about 10' + (U.S.G.S. Datum). The invert elevation for the Conduit crossing under the "depressed" alternative is estimated about -5. Therefore, in this alternative, relocation of the conduit would be accomplished by a siphon appropriately designed so that it will be hydraulically efficient and self-cleaning. If hydraulic calculations prove it to be necessary, a pumping facility would be installed to assist the siphon operation and to prevent any flooding in emergency situations.

In the "modified embankment" alternative, no relocation of the Stony Brook Conduit at this crossing would be necessary. However, examination during the design phase of the project of its structural reliability may prove to be deficient, in which case it will be either relocated or structurally strengthened.

Roxbury Crossing. The Conduit at its Roxbury crossing is an oval shapped, 17'-0" x 15'-6" sized concrete structure constructed in 1888. In this area the Conduit not only crosses the Corridor, but also runs parallel to and beneath the proposed rail/transit tracks and station for approximately 700 feet.

In the depressed or modified depressed alternatives, this relocation, where it crosses the tracks, would be a siphon crossing similar to the Forest Hills crossing and assisted by a pumping facility if necessary.

In the "modified embankment" alternative, this portion of the Conduit will be relocated also. Its relocated length will depend on its structural sufficiency, which will be determined during the design phase of the project.

Ruggles Street Crossing. Another major crossing of the Corridor is located at Ruggles Street, where the Old Stony Brook Double Channels cross the existing Penn Central railroad. This crossing presently consists of two large size branches. One branch is of brick, constructed in 1886, and the other branch is of concrete, constructed in 1909.

In the depressed alternative, the relocation will consist of constructing an appropriately sized siphon at each crossing.

For the modified embankment alternative a siphon would not be required.

5.2.5.4 Traffic Flows

Traffic flow in the study corridor would be disruptive under all alternatives but to a varying degree of severity. The following descriptions are intended as illustrative of one method of construction sequence for purposes of describing impact.

Alternative SC-1 South Cove to Camden Street with Minor Grade Adjustments for all Tracks

The third construction contract, Camden Street to Arlington Street would be phased to dovetail into the progress of the second construction contract. There could be no disruption of the rail service until the major portion of earth moving has been completed in the preceeding contract.

The phase of this contract which would be disruptive to traffic would be the replacment of the local street bridges over the proposed rail/transit right-of-way. The structures to be reconstructed in this contract are: Berkeley Street, Columbus Avenue, Clarendon Street, Dartmouth Street and Massachusetts Avenue. Buckingham Street which runs parallel to and south of the Penn Central right-of-way between Clarendon Street and Dartmouth Street will be replaced and would be reconstructed completely on structure.

The replacement of the structures in the third contract would be scheduled to suite the local street pattern. Berkeley Street would be closed to traffic and traffic rerouted to Columbus Avenue and Arlington Street (with the assumption Arlington Street has been replaced under the South Cove Tunnel extension contract).

While Berkeley Street was being reconstructed, the replacement of Dartmouth Street would begin. Traffic would be rerouted to Clarendon Street and Columbus Avenue. Clarendon Street would be temporarily made two-way between Columbus Avenue and Boylston Street.

Massachusetts Avenue, which, with the exception of West Newton Street, is somewhat isolated relative to any interaction with the other structures being replaced, would be scheduled for replacement independent of the structure replacement in the Back Bay Station area. The one controlling factor is that rail service to the excavation area in contract 2 must be maintained. Massachusetts Avenue would be closed to traffic, West Newton Street temporarily made two-way between Huntington Avenue and Tremont Street and a temporary grade-crossing established at Gainsborough Street/Camden Street and the railroad. Rail traffic at this location would be restricted to that time when construction is in progress in the second contract. Crossing guards would be required during those hours. The West Newton Street structure would be reconstructed subsequent to the Massachusetts Avenue reconstruction. West Newton Street would be closed with traffic being rerouted to Massachusetts Avenue.

Subsequent to the completion of the Dartmouth Street structure the combined structure of Clarendon Street, Columbus Avenue and Buckingham Street would be closed to traffic and dismantled. Traffic would be rerouted from Columbus Avenue to Dartmouth Street and Stuart Street. Berkeley Street would be temporarily made two-way between Boylston Street and Tremont Street. Appleton and Chandler Streets could handle rerouted traffic as well as Dartmouth Street.

The temporary closing of the Massachusetts Avenue bridge described above was predicated upon the avoidance of additional structure demolition. With that restriction, a detour bridge and approaches could not be constructed adjacent to the existing structure. The suggestion by the neighborhood and the City of Boston at the Southwest Corridor Public Hearing on July 15, 1976 to build a temporary detour requires the demolition of an additional structure on Massachusetts Avenue. This demolition is contemplated as perhaps being required to provide the continuous deck for noise control. If the structure cannot maintain the underpinning required to provide for these noise control measures it will be demolished. A determination of its structural capability will be made in the engineering design phase.

The impact upon traffic flows if the Massachusetts Ave bridge were temporarily closed would be to force traffic to use other existing arterial streets which would be more circuitous and in many cases restricted by parked cars. The action of closing Massachusetts Avenue would encourage many motorists to seek other routes by which to reach their destination. The cost attributed to this scheme is included in the cost estimate presented herein.

The construction of a 4-lane detour bridge adjacent to the existing structure is considered feasible and would allow Massachusetts Avenue to remain open to traffic.

A temporary 4-lane detour bridge, with a minimum 8-foot sidewalk on the north side, would be totally independent of and sited to the north of the present Massachusetts Avenue bridge. The detour bridge would be of simple construction spanning a width necessary for only one active railroad track below. The particular type of structure must lend itself to rapid construction and easy dismantling. The detour bridge approaches to Massachusetts Avenue will require a reduced speed of 10 miles per hour. This arrangement for a temporary bridge and approaches will permit the complete and uninterrupted demolition and reconstruction of the Massachusetts Avenue overpass bridge while at the same time provide for existing traffic patterns to be maintained.

The cost of constructing and dismantling the detour bridge would be approximately $125,000.

The ability to maintain present traffic patterns and not force people into alternate paths, which may already be overloaded, is considered to be preferable from an environmental view than the original "no detour" option, provided that the demolition contemplated would occur for reasons of noise control construction.

<u>Alternative SC-2</u> <u>South Cove to Camden Street with Orange Line in Tunnel to Dartmouth Street.</u>

Construction of this alternative would create traffic flow disruption similar to those of SC-1.

<u>Alternative FH-1</u> <u>Depressed Rail/Transit, No Arterial Street</u>

Construction of this alternative would create traffic flow disruptions throughout the length of the project. The major problem areas will occur from Ruggles Street south to Forest Hills due to the elimination of the existing embankment section and construction of a depressed section.

The Ruggles Street to Forest Hills section would be broken into two construction contracts with the contractors beginning at a common point and working away from each other utilizing the existing railroad to transport the spoil material away from the area.

The removal of the embankment would preceed by a significant margin the excavation of the depressed section due to the preparation required and the method of excavation. Therefore, the embankment would be removed, the structures dismantled and the local cross streets left open. As the excavation of the depressed section proceeds, each street would be closed, the concrete shell of the depressed section constructed and subsequently the new local street bridge erected.

With the first contract extending from Forest Hills to a point midway between Boylston Street and Mozart Street, the traffic patterns would be as follows:

> Boylston Street would be closed to traffic which would be rerouted to Mozart/Atherton Street and Green Street. As construction proceeds southerly, Green Street would be closed and traffic rerouted to Williams Street and Mozart/Atherton Street. Following Green Street, Williams Street would be closed with traffic being rerouted to McBride Street and to Boylston Street which would now be open to traffic. Proceeding southerly, McBride Street would be closed, but it would be unadvisable to keep Williams Street closed concurrently with McBride Street, therefore, a temporary structure would be erected at Williams Street until such time as the permanent McBride Street structure would be open for traffic.
>
> Morton Street East and Morton Street West, under Alternative FH-1, would be constructed as a divided roadway and bridge north of the Arborway.
>
> East Morton Street would remain open and handle two-way traffic until relocated Morton Street was built and opened to traffic. East Morton Street would then be abandonned to become part of the proposed Forest Hills Station complex.

Work on the second contract which begins at the northerly limit of the first contract and extends to Camden Street would begin approximately 3 months after the start of the first contract with the following temporary traffic pattern changes.

Mozart Street would be closed with traffic rerouted to Boylston Street. Excavation would continue north to Centre Street which would be closed with traffic being rerouted to Heath Street. A temporary bridge would be erected at Centre in order to service this major traffic corridor. Heath Street would be closed and traffic rerouted to New Heath Street and to the temporary bridge at Centre Street. The excavation would continue northward to New Heath Street which would not be closed until the Heath Street bridge has been built and open to traffic. The excavation for the depressed section would continue north to Tremont Street. When Tremont Street is closed to traffic a temporary detour road would be required to link Tremont Street to Station Street on the west side of the tracks. Station Street would temporarily be widened to accommodate the additional traffic diverted from Tremont Street. Excavation would be continued north of Station Street to Prentiss Street which would be closed to traffic. Traffic would be routed back to Station Street. Proceeding north, Ruggles Street would be the next cross-street to be closed to traffic. Due to the importance of this street coupled with the fact that it is somewhat isolated, there would be a detour road built along the westerly side of the existing right-of-way and a temporary crossing constructed north of Ruggles Street. This would remain in service until the proposed Ruggles Street crossing was open to traffic. Following the construction of the Prentiss Street structure, work would begin on the Station Street structure with traffic being diverted to Prentiss Street.

Alternative FH-2 Depressed Rail/Transit, Arterial Street East

Construction of this alternative would create all of the traffic flow disruptions as would be created under alternative FH-1 in addition to those which would be caused by the Arterial Street.

Segment #2 Arterial Street

Assuming the rail/transit facility was constructed first and all the cross streets were reconstructed to permanent line and grade, it would be necessary to construct a detour road parallel and east of the proposed Arterial Street from Ruggles Street to Jackson Square. Upon completion of the detour road, traffic would be rerouted from Tremont Street and Columbus Avenue to the detour road. The traffic on the cross streets between Ruggles Street and Jackson Square would function freely while the Arterial Street was being constructed. As each cross street was being tied into the Arterial Street there would be some short term closings but this would be done with only minor disruptions to traffic. Upon completion of Segment #2 of the Arterial Street, traffic will be transferred to the Arterial Street from Ruggles Street to Jackson Square.

Segment #3 Arterial Street

Segment #3 of the Arterial Street will not involve any detour roads. Reconstruction of the cross street and any relocation of local streets would be done prior to the construction of the Arterial Street. The entire length of Segment #3 would be constructed before any section of it would be opened to traffic. Closing of the cross streets to traffic would occur only when each street was being tied into the Arterial Street and would be of short duration.

Alternative FH-3 Embankment Section, No Arterial Street

The same construction contract limits used in the Alternative FH-1 will be used for Alternative FH-3. The alternative necessitates the raising and widening of the present embankment, the dismantling of existing bridges over local streets, the construction of new bridge abutments, and retaining walls, the building of new rail/transit stations, the erection of new rail/transit bridges over local streets and the laying of new trackage.

The traffic patterns for Alternative FH-3 during construction could be as follows:

Boylston Street would be closed to traffic during the construction of the bridge over Boylston Street and traffic would be detoured to Mozart/Atherton Street and Green Street. Green Street would be closed to traffic following the completion of the structure at Boylston Street and traffic would be rerouted to Boylston Street and Williams Street. Following the completion of the structure over Williams Street, McBride Street will be closed to traffic which would be detoured to Williams Street. Morton Street, which consists of two roadways separated by the Arborway could be reconstructed independently of the other cross streets. Morton Street East would be made two-way, Morton Street West would be excavated and the proposed relocated Morton Street built north of the Arborway. Following the opening of the relocated Arborway, Arborway East would be abandoned and become part of the Forest Hills Station complex.

The second construction contract would begin immediately after Boylston Street was re-opened for traffic. The construction of the bridges in this contract would create no particular problem in re-routing of traffic. The structures would be replaced in the order of Mozart/Atherton Street, Centre Street, Heath Street, New Heath Street, Tremont Street, Station Street, Prentiss Street, and Ruggles Street. The only restriction being that a street must be open for traffic prior to the next one being closed.

Alternative FH-4 Rail/Transit on Modified Embankment
Arterial Street Crossing East to West

The impacts upon traffic flow caused by the construction of the rail/transit facility under Alternative FH-4 would be identical to those under Alternative FH-3. The impacts upon traffic caused by the construction of Segment 2 of the Arterial Street would be identical with those described in Alternative FH-2.

Segment 3 Arterial Street crossing East to West. The reconstruction of the cross streets and relocation of local streets in the area would be done prior to the beginning of the Arterial Street construction. The Arterial Street would be constructed without disruption to the local traffic except for short term closing of the cross streets when the Arterial Street was being tied into the cross streets. Traffic would be allowed on the Arterial Street only when it was completed.

Alternative FH-5 Modified Depressed Rail/Transit
Arterial Street Ruggles Street to Forest Hills

Construction of this alternative would create traffic-flow disruptions throughout the length of the project. The major problem areas will occur from Ruggles Street south to Forest Hills due to the elimination of the existing embankment section, the construction of a depressed section and the reconstruction of the local cross streets.

The Ruggles Street to Forest Hills section would be broken into two construction contracts, with the contractors beginning at a common point and working away from each other. The existing railroad would be used to transport spoil material.

Existing track bridges would be dismantled. Tracks, ties and ballast would removed. The embankment material regraded to the proposed finished grade. Excavation for the concrete shell of the modified depressed section would follow and local cross streets closed for construction as scheduled.

Construction of the first contract (Mozart Street to Forest Hills) includes new crossings which are being proposed at Gordon Street and at Lorene Place. Construction at these two locations would begin at the initial stages of the contract. Boylston Street would be closed. Traffic would be rerouted to Mozart/Atherton Street. McBride Street would be closed and its traffic rerouted to Williams Street.

Morton Street East and Morton Street West would be constructed as a divided roadway and bridge north of the Arborway. East Morton Street would remain open and handle two-way traffic until relocated Morton Street was built and opened to traffic. East Morton Street would then be abandonned to become part of the proposed Forest Hills Station complex.

Following the construction of Gordon Street and Lorene Place, traffic would be routed to them. Green Street would be closed for construction. When construction of McBride Street was finished, it would be opened to traffic. Williams Street would be closed for construction.

Work on the second contract (begins at the northerly limit of the first contract and extends to Camden Street) would begin approximately three months after the start of the first contract. The following temporary traffic-pattern changes would pertain:

Mozart Street would be closed and its traffic rerouted to the reconstructed Boylston Street. Construction would continue north to Centre Street which would be closed. Its traffic would be rerouted to Heath Street and New Heath Street. Construction of a new crossing to be introduced at Cedar Street would begin at the initial stages of the contract. Tremont Street would be closed for reconstruction with traffic being rerouted to Station and Prentiss Street. A detour road north of the Ruggles Street Station would be constructed and Ruggles Street closed for reconstruction. Following the opening to traffic of the newly constructed Mozart Street, Centre, Cedar, Tremont, Ruggles, and Heath Streets would be closed for reconstruction. Station Street and Prentiss Street would be dead-ended at the right-of-way line and the detour road at the Ruggles Street Station would be removed.

The arterial street (Ruggles Street to Jackson Square) being proposed in conjunction with Alternative FH-5 would be treated in a similar way in which it would be handled in Alternative FH-2. There would be one exception: the detour road would have to be built prior to regrading the area outside of the rail/transit concrete section.

Alternative FH-6 Modified Depressed Rail/Transit Arterial Street Ruggles Street to Jackson Square

The impact upon traffic flow by Alternative FH-6 would be the same as that for Alternative FH-5. The major difference in the concept of the two alternatives is that the arterial street from Jackson Square to Forest Hills would not be built under Alternative FH-6.

Alternatives PHP-1 and PHP-2 Post Hearing Rail/Transit Profiles

The impact upon traffic flow by these alternatives would be the same as for Alternatives FH-6 and FH-5, respectively.

5.2.5.5 Pedestrian Movements

Pedestrian circulation could be maintained elsewhere at locations where street bridges were out of service during new bridge construction by the use of temporary bridge structures acorss the right-of-way. A final determination of the appropriate location of such pedestrian crossings will be made during the design phase, though the locations currently in use would be reduced in number

Alternative SC-1 and SC-2 South Cove to Camden Street

Alternatives SC-1 and SC-2 involve the area from Camden Street to South Cove with 2- to 5-foot grade adjustments for all tracks. There are five local street bridges over the railroad which would be reconstructed under these alternatives. The scheduling of bridge replacements may vary depending on many factors. Generally, no adjacent bridges will be worked on concurrently because the traffic pattern needs to be maintained. Pedestrian traffic can be rerouted without difficulty. It would be important to maintain pedestrian traffic at Massachusetts Avenue, which is the first location. To build a temporary crossing adjacent to the bridge site would be extremely difficult due to space restrictions. The best solution would be to build the proposed Massachusetts Avenue structure in two sections. Rerouting pedestrian traffic to adjacent streets would be highly circuitous and inadvisable at this location.

During the reconstruction of Dartmouth Street, pedestrian traffic would be rerouted to Clarendon Street. A temporary pedestrian overpass at Dartmouth Street would not be feasible because of space restrictions and the maze of trackwork below.

While Clarendon Street/Columbus Avenue is closed to traffic, pedestrian traffic would be rerouted to Berkeley and Dartmouth Streets. When Berkeley Street is being reconstructed, traffic would be rerouted to Arlington Street or Columbus Avenue.

Alternatives FH-1 and FH-2 Depressed Rail/Transit

Pedestrian travel across the project during construction would not pose any problems of major proportions. Cross movements at present are restricted to existing local street crossings, at a few isolated pedestrian overpasses and at one pedestrian underpass.

In the first construction contract, which extends from Forest Hills to a point midway between Boylston Street and Mozart Street, there are now seven locations where pedestrians can cross the Penn Central right-of-way. When removal of the embankment begins, the local streets which now cross under the railroad will remain open until excavation for the depressed section approaches that location. At that time, temporary pedestrian overpasses would be erected adjacent to the bridge site. They would remain until such time as the local street bridge is open to pedestrian traffic.

To eliminate a pedestrian crossing in this section, without some type of temporary means of crossing at the same location, would create a hardship for many of the area's residents.

The second construction contract, which extends from the northerly limit of the first contract to Camden Street/Gainsboro Street, has seven locations where pedestrians cross the rail corridor. All of these locations would have temporary pedestrain overpasses erected adjacent to the local street bridge site during the construction of the permanent structure.

Alternatives FH-3 and FH-4 Rail/Transit on Modified Embankment

Pedestrian movement across the project corridor during the construction of either of the embankment alternatives would pose no significant problems. Street closings would occur only during the placing of bridge cross members over the local streets.

Alternatives FH-5 and FH-6 Modified Depressed Rail/Transit

Pedestrian movement across the project corridor during the construction of either of the modified depressed alternatives would present serious problems. The problems would be caused by the distance pedestrians would have to travel to cross the corridor as each street was closed. The length of time each street would be closed would be significant due to the major construction involved in rebuilding most of the streets under the modified depressed alternatives. Temporary pedestrian walkways and overpasses would be difficult to introduce at many of the street crossings.

Alternatives PHP-1 and PHP-2 Post Hearing Profile

Pedestrian movement across the project corridor during the construction of Alternatives PHP-1 and PHP-2 would be the same as for Alternatives FH-6 and FH-5, respectively.

5.2.5.6 Construction Noise

Construction and demolition activities will contribute to high noise levels in the vicinity of the arterial and proposed highway and transit facilities for the estimated three to four year construction period. The actual noise level at any location will depend upon the chosen alternative and the staging of the various construction phases. For example, constructing the transit in a full or modified cut will require extensive piling and dewatering along the entire length of the cut section. In addition, water recharging will probably be needed for structures near to the dewatering areas. If, on the other hand, the transit is built on the existing embankment, much of the sheet piling and water pumping operations will not be required.

The noise created by construction operations is regulated by a number of Federal, State and local laws. The FHWA requires that construction noise be considered in the Environmental Assessment stage of the project. The Federal Highway Program Manual 773 requires the following:

1. Identify land uses or activities which may be affected by noise from construction of the highway. The identification is to be performed during project development studies.

2. Determine the special provisions which are needed in the contract documents to minimize or eliminate adverse construction noise impacts to the community. This determination shall include a weighting of the benefits achieved and the overall adverse social, economic and environmental effects and costs of the special provisions.

3. Incorporate the needed special provisions in the contract documents.

For this project it is estimated that construction noise levels could exceed the 67dbA criteria used for the completed project out to a distance of from 400 feet to 800 feet from the construction site, where no buildings intercept the sound waves.

Special provisions to reduce such construction noise should include: daytime hour limitations on construction activity; well-muffled equipment, the quietest equipment used in the most sensitive locations. Sonic or vibratory pile drivers could be used for the extensive sheet piling required for the project in areas where settlement is not of concern. Since no acceptable bearing formulas that indicate pile-bearing capacity have as yet been developed for sonic or vibratory drivers, all foundation piling will still require impact-type hammers.

The EPA has recently promulgated regulations requiring that new trucks and air compressors comply with certain noise limits. The new equipment that the contractor owns or rents will necessarily be quieter than the old and should be used on all sensitive locations.

UMTA has no construction noise regulations regarding the construction of a rapid-transit system, but usually relys upon the regulations of other agencies to limit construction noise.

Noise levels at the construction site will also be limited in terms of a worker's exposure to noise. These limits are set by OSHA and presently require that a worker's eight-hour dosage of noise not exceed an L_{eq} of 90dBA.

The Massachusetts Department of Public Health mentions construction and demolition noise in regulation 10. As a policy matter, the Department of Public Health suggests that all equipment be well muffled and that construction be limited to daytime hours.

The Boston Air Pollution Control Commission has specific regulations concerning construction noise. Noise regulations 4 and 6, limit construction noise-levels for various land uses and set a limit of 85dBA at 50 feet for all construction equipment except pile drivers.

In order to estimate construction noise levels, a typical construction scenario for highway and transit projects was used, with appropriate modifications to account for the extensive piling and dewatering which might be required. In all, three different scenarios were considered:

1. The first construction scenario assumed equipment of typical noise level, modified to include extensive piling and dewatering. This would represent the worst-case situation.

2. The second scenario assumed the same equipment-usage factors as the first scenario, but with the quietest available equipment.

3. The third scenario assumes that all equipment complies with the City of Boston Air Pollution Control Commission Noise Regulation 6 and does not include the effects of pile driving, per BAPCC noise regulation 4.

In all of the above cases the eight-hour time average A-weighted sound level, L_{eq}, is calculated at 50 feet from the construction site. For the third scenario this value is also converted to an L_{10} sound level based on the results of a highway construction noise survey conducted by the New York State Department of Environmental Conservation. The results of these calculations are as follows:

1st scenario L_{eq} = 93 dBA at 50'
2nd scenario L_{eq} = 85 dBA at 50'
3rd scenario L_{eq} = 90 dBA at 50'
3rd scenario L_{10} = 93 dBA at 50'

These examples illustrate that construction-noise levels will be quite high and that all reasonable means for reducing construction noise should be employed. It may not be feasible to require all contractors to use only new quieter equipment, but it is reasonable to expect that all equipment should be muffled. The contractor should be required to use newer and quieter equipment in sensitive locations where residences are located very close to the construction site. As seen in the above tables, this could result in an 8dB reduction in construction noise. Nevertheless for residences very close to the site noise levels will be quite high. If a residence is 25 feet from the construction site, the predicted noise level, even with quieted equipment, will be 90dBA.

The data shown on Figure II-24 indicate L_{eq} levels caused by today's railroad operating range from 66 to 78 dBA. In the alternatives which diverts all railroad service, the noise levels would be reduced during periods when construction equipment was not in use.

The situation will be improved somewhat for residences located farther from the construction site. If the distance from site to residence is 100 feet, the predicted L_{eq} will be 89dBA for scenario one and 81dBA for scenario two. At 200 feet, the respective values would be 84dBA and 76dBA. These predicted levels assume a clear line of sight between the construction site and residence. For the second row of houses, these values will be from 5 to 10dB lower. Consequently, even with quieted equipment and assuming at least one row of houses, construction noise impact will occasionally extend out to approximately 400 feet where the L_{eq} will be approximately 67dBA. It is anticipated that the Commonwealth will require contractors to meet the requirements described in Scenario 2.

5.2.5.7 Air Quality Impacts During Construction

Air-quality impacts associated with construction of this project will consist principally of fugitive-dust emissions associated with excavation and land-fill activities.

Measures to minimize such impacts include contract specifications for handling material in trucks adequately covered by tarpolins, frequent watering to hold down dust, and street cleaning in the work areas.

Total emissions from construction equipment would be insignificant (see Section 6.2.7).

5.2.5.8 Commercial Disruption During Construction

Retail stores on Hyde Park Avenue at Forest Hills will be impacted by construction activity and changes in traffic flow. If a temporary Orange Line station must be built at some distance from the present one, then patronage of these stores may be reduced.

Commercial activities farther south on Washington Street will be affected if traffic flow is interrupted for a lengthy period.

Operations of American Celophane and Hanson Contracting near Green Street may be hampered by restricted access, noise and dust. Similarly, retail activity on Green Street may be affected by construction activity.

J & M Contracting at 267 Amory (if not acquired for right-of-way) will be affected by construction work in close proximity. Industrial activity east of the right-of-way between Atherton and Boylston may be affected by noise and dust, however, access will not be affected in a major way.

A wood frame office/industrial structure at 121 Lamartine Street may be adversely affected by reduced access, noise and dust. Hammond Office Products supply warehouse at Lamartine and Roys Streets would be somewhat affected by reduced access, noise and dust through the building openings near the construction area. Industrial activities on Amory Street between Dimock Street and Jackson Square would be minimally affected by reduced access, noise and dust.

Dismantling of the Washington Street Elevated will cause temporary interruptions as the structure is removed. Any one segment will only be interrupted for a few days. The traffic flow will be hampered for a substantial period of time. This will increase traffic on Forest Hills, Amory, Lamartine, Call, South and Centre Streets, or on the new arterial if it is constructed between Jackson Square and Forest Hills. Commercial activity on Washington Street will suffer to a small degree from the affect of reduced vehicular traffic during the short demolition period. Details of the construction process for the removal of the Elevated are given in Section 5.8.

5.2.5.9 Inconveniences Due to Rail Service Diversion

During the construction phase, rail service in the corridor could be diverted to the Midland Branch.

While this diversion would greatly simplify the construction procedures for the Project, riders using Midland service would not be able to reach Back Bay directly. See Section 6.2.9.1 for impacts and service alternatives during construction.

Under several alternatives service on the Needham Branch would also be discontinued causing an inconvenience to Needham Center, Roslindale and West Roxbury riders. Section 6.2.9.2 describes service alternatives during construction.

5.3 Air Quality Impacts

5.3.1 Analysis Objectives. The objectives of the air quality modeling analysis were to evaluate the impacts on community air quality of different project alternatives for both commuter rail operations and the proposed arterial street. The analysis was performed principally on two levels: a macroscale analysis which projected the total area emissions of each pollutant for each strategy and a microscale analysis which determined expected pollutant concentrations at sensitive receptors in the area. The latter study was performed only for carbon monoxide, as hydrocarbon and nitrogen oxide concentrations are intimately related to complex atmospheric photochemical processes. These reactions are more of a regional phenomenon and are, therefore, not readily amenable to analysis of localized ambient air quality impact.

Additional air impacts examined were those associated with parking facilities at the Forest Hills MBTA station, increased electrical power usage on the MBTA Orange Line, and emissions from related land use development in the Southwest Corridor.

5.3.2 Description of Atmospheric Diffusion Model. All predicted carbon monoxide (CO) concentrations for this study were determined using the APRAC-1A urban diffusion model developed at the Stanford Research Institute.[1]* The model simulates CO concentrations from readily available meteorological and traffic data. It is based on the Gaussian plume configuration and incorporates results from several recent research studies[2,3,4]. Emission sources are specified in two forms: a primary network of traffic road segments or links and a secondary grid of area sources. The model calculates pollutant concentrations from diffusion on various scales, ranging from extraurban diffusion of sources in upwind cities to intraurban diffusion of freeway, arterial, and feeder street sources. In addition, a submodel was employed to deal with the helical air circulation typical of street canyons. One-hour average CO concentrations are calculated as a function of time, for comparison and verification with observed concentrations and for operational applications.

---

* The model was modified to allow representation of elevated sources.

[1] Mancuso, R.L., and Ludwig, F.L., User's Manual for the APRAC-la Urban Diffusion Model Computer Program, Environmental Protection Agency, Division of Meteorology, Research Triangle Park, North Carolina, September, 1972.

[2] Johnson, W.B., Dabberdt, W.F., Ludwig, F.L., and Allen, R.J., Field Study for Initial Evaluation of an Urban Diffusion Model for Carbon Monoxide.

[3] Ludwig, F.L., Johnson, W.B., Moon, A.E., and Mancuso, R.L., A Practical Multipurpose Diffusion Model for Carbon Monoxide.

[4] Ludwig, F.L., and Dabberdt, W.F., Evaluation of the APRAC-1A Urban Diffusion Model for Carbon Monoxide.

The computer program VEHEMI was integrated into the model to determine more accurately vehicle CO emission rates. VEHEMI is designed to compute, using EPA methodology, the CO emission rate (grams CO/vehicle mile) for a specified motor vehicle model year mix--in this case, a mix typical of the Boston area--and allows for explicit imput of the ratio of light to heavy-duty vehicles. It replaces an older empirical equation in APRAC-1A that was previously used for this purpose. The method used is based on a procedure outlined by Kircher and Armstrong[1] and incorporates such considerations as deterioration and speed adjustment factors. Also, recent changes in the Federal automobile emission standards related to amendments to the Clean Air Act of 1970 have been incorporated into VEHEMI[2].

5.3.3 Meteorological Factors. It is generally agreed that the meteorological factors directly involved in predicting pollutant concentrations are transport and dilution by the mean wind and dispersal by atmospheric turbulence[3]. These meteorological parameters exhibit important time and space variations, particularly in the lower several thousand feet, where air pollution problems are most acute. The character of the variations in these properties is, in turn, strongly related to the vertical thermal structure of the atmosphere in this boundary layer. During conditions of an unstable atmospheric thermal structure, both horizontal and vertical dispersion of pollutants is enhanced, whereas in stable atmospheres, the reverse conditions apply. Consequently, the thermal stability of the ambient air is an important factor in determining the dispersion properties in a given region.

Another important meteorological parameter is the mixing depth, the vertical thickness of the atmospheric layer in which turbulent mixing can diffuse the emissions. Deeper mixing depths will permit the pollutant to be dispersed into larger volumes, resulting in lower ground-level concentrations. Under certain meteorological conditions, principally low-level temperature inversions, this thickness can be severely limited--thereby trapping the pollutants within a shallow layer near the ground. The mixing depth within a region generally varies both with the season and with the time of day.

Thus, the dispersion properties of the atmosphere at any particular time can be described in terms of the joint occurence of specific conditions of thermal stability, mixing depth, and wind. These meteorological factors are highly interrelated and are observed to occur in combinations of different conditions with varying frequency.

---

[1] Kircher, D.S., and Armstrong, D.P., An Interim Report On Motor Vehicle Emission Estimation (Draft), Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, October, 1972.

[2] Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, Environmental Protection Agency, Office of Air and Water Programs, Publication No. AP-42, Second Edition, Supplement, Research Triangle Park, North Carolina.

[3] Pasquill, F., Atmospheric Diffusion, D. Van Nostrand Company, Ltd., New York, NY, 1962

The APRAC-1A urban diffusion model used in this study to model air quality impacts is designed to be generally applicable to any city where conventional airport weather observations are taken. Airport surface wind speed and direction can be used directly. Special methods were developed to calculate the mixing depth and stability index from the available meteorological observations. The method used for the mixing depth calculation is based on the National Weather Service's 1200 GMT upper air temperature sounding. This sounding, together with the maximum afternoon temperature at the surface permits the afternoon or maximum mixing depth to be calculated. The morning or minimum mixing depth is calculated by using a simple urban model and an empirical relationship involving city size and urban and rural nighttime temperatures. Hourly mixing depths are then interpolated on the basis of the observed hourly surface temperatures for the daylight and pre-midnight hours; mixing depth is assumed to be constant between the hours of midnight and dawn. The method used to determine the stability index depends on prevailing solar insolation and wind speed during daylight hours and on cloud opaqueness and wind speed during nighttime hours.

5.3.4 Traffic Data Base. The urban diffusion model used in this study requires a traffic data base structured on two levels. First, a high-resolution primary network of road segments or links is specified. Input parameters are the location, length, level of service, and average daily traffic (ADT) for each link. Second, a grid of area sources to handle traffic emissions which do not require a high spatial resolution is defined. Imput here consists of the area and location of the grid squares and the 24-hour vehicle miles traveled (VMT) within each square.

As part of a program to develop a Metropolitan Boston Transportation Control Plan (MBTCP), transportation data were gathered for Boston and the environs included within circumferencial Route 128. The region was divided into three areas corresponding to the inner city and the inner and outer suburbs (see Figures V-15 and V-16). A grid was superimposed upon each of these three areas so that each grid cell contained a uniform density of traffic activities. Thus, the size of the grid used in each area was a function of urban densities and activity concentrations.

The MBTCP study[1] categorizes 1971 and projected 1977 daily VMT (vehicle miles travelled) for each grid cell in the Metropolitan Boston area by facility type (freeway, arterial, collector, and local). Appropriate daily VMT data for 1975, 1980 and 2000 were derived from the projected VMT data in the report for imput as the secondary grid of area sources in the model. The primary grid network (Figure V-17) consisted of average daily traffic volumes and estimates of total peak-hour and 8-hour traffic demand for each link of the primary network. The VMT of the primary link network represented approximately 80 percent of the total daily surface VMT in the project corridor area. The remaining 20 percent was accounted for by secondary area sources.

Traffic volume data were provided for the following cases:

1) Existing (1975) traffic volumes on the existing street network applicable for the no-build condition.

2) Existing (1975) traffic reassigned to reflect a build condition on Segment #2 and no-build on Segment #3.

---

[1] Transportation Controls To Reduce Motor Vehicle Emissions in Boston, Massachusetts, U.S. Environmental Protection Agency Publication No. APTD-1442, December, 1972.

3) Existing (1975) traffic reassigned to reflect a build condition on both Segments, #2 and #3.

Appropriate traffic volumes were extracted from these three networks for each of the seven build alternatives evaluated.

Projections of traffic volumes for 1980 reflected a zero growth between 1975 and 1980. This was based on a growth trend between 1964 and 1974 which showed a reduction for certain critical arterial streets in the Southwest Corridor.

Projections of traffic volumes for 2000 reflect a capacity value for the arterial street segments and no change in volume on other streets.

In addition to the traffic volume data, average peak-hour and 8-hour vehicle speeds and the ratio of light to heavy-duty vehicles in the project corridor were included in the analysis.

A total of four alternatives were considered for the construction and location of the proposed arterial street. Each of the alternatives was analyzed for the years 1975, 1980, and 2000. A brief description of each alternative is as follows:

No Build

Alternatives FH-2b, FH-6, PHP-1

Build only Segment #2 of the proposed arterial. This would be a six lane segment extending from Ruggles Street between Tremont Street and Columbus Avenue to Centre Street in Jackson Square. This segment would be located just east of the present Penn Central Railroad Tracks.

Alternative FH-2, FH-5, PHP-2

Build Segments #2 and #3 of the proposed arterial. For this alternative, the arterial would be built from Ruggles Street to the present Forest Hills rail station located near the intersection of Washington Street and Hyde Park Avenue. Segment from Jackson Square to Forest Hills would be a four lane segment built just east of the depressed Penn Central railroad.

Alternative FH-4

Build Segments #2 and #3 of the proposed arterial. Segment #3 of the arterial would cross the Penn Central rail just south of Atherton Street and be located west of the rail from this point to the Forest Hills rail station. The rail facilities are on a modified embankment in this scheme.

Various alternatives for the railroad and transit system were associated and analyzed with each of the arterial street alternatives. A brief description of each rail/transit alternative is as follows:

A) To leave the existing rail and transit systems as they presently are with the rail on an embankment and the transit elevated on Washington Street.

B) To leave the existing rail on the embankment and to move the transit from Washington Street onto the embankment with the rail.

C) To depress the rail and transit systems below street level where the present rail embankment is located.

Analyses indicated that for each arterial street alternative, the air quality differences between each of these rail/transit alternatives were negligible. This was due to low emissions from the rail and transit systems in relation to the primary link network and to very slight traffic volume differences on the primary network as a result of the three rail/transit alternatives. Therefore, the different rail/transit alternatives are not discussed in the section on the air quality impacts and, concentrations from each of the rail/transit alternatives considered for each arterial street alternative can be considered equivalent. A complete description of each of the arterial streets and the rail/transit alternatives is included elsewhere in the EIA, Environmental Impact Analysis.

Figure V-18 presents projected total VMT for the primary link network for each of the arterial build alternatives and for each of the design years evaluated. Secondary grid VMT by grid were estimated by substracting primary link VMT from total VMT in the grids containing the primary link network surrounding the project corridor. Other grids were not affected by this procedure.

5.3.5 Model Validation. For the purpose of verifying the accuracy of a diffusion model in predicting CO concentrations for an area, a model validation exercise is usually performed. This entails modeling the region for CO concentration during several time periods for which on-site CO, traffic, and meteorological measurements are available, comparing the results statistically, and drawing conclusions.

Since an ambient monitoring program was not performed as part of this study, it is not possible to validate the APRAC-1A model for the Southwest Corridor. However, the APRAC-1A model was used recently in two other air quality studies in the Boston area, where model validation was performed. In both of these studies, the model provided CO predictions that were well correlated with CO measurements in the project area, with correlating coefficients in the range of 0.8 to 0.9. These results indicate that APRAC-1A is an accurate state-of-the-art model for predicting ambient CO levels in urban areas, such as the Southwest Corridor.

In the current study, output from the APRAC-1A model was used directly in the analysis. No attempt was made to add a background concentration to the predicted concentrations or to scale the results by a calibration factor. Experience with the APRAC-1A model has shown that both of these factors vary considerably with the average roadway speeds and traffic volumes input to the model. In addition, the traffic data input to the model included area source emissions for background sources in the Boston region.

5.3.6 Macroscale Analysis of Emissions. The quantity of each pollutant released from motor vehicles in the project area for each case was estimated by the computer program VEHEMI, which applies the most recent EPA motor vehicle emission factors to the projected traffic volumes on project area roadways. The emission factors for carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides (NO_x) used in these computations are shown in Figure V-19 distributed by calendar year and pollutant. These factors reflect vehicle mix by model year, weighted travel by age of vehicle, deterioration of control devices as a function of model year and age, the split between light and heavy-duty vehicles on each roadway, and the effect of the BTCP's proposed semi-annual emissions inspection/maintenance program. Rail emissions were extracted from the UMTA report[1] and were assumed not to vary with time.

---

[1] "Characteristics of Urban Transportation Systems," U.S. Department of Transportation, UMTA, May, 1975.

Estimates of total vehicular emissions of carbon monoxide, hydrocarbons, and nitrogen oxides from the primary link network were prepared for the seven alternatives and for the years 1975, 1980, and 2000. No attempt was made to incorporate emissions from the secondary grid network, as this was based on a general study of the Boston area and uses areawide averages of VMT growth rate and vehicle speed. These data would tend to obscure the detailed changes resulting from the various options which are incorporated into the primary network. Analysis of the motor vehicle emission factors indicates a sharp decrease in emissions from calendar year 1975 to 1980 and 2000. This decrease results from several factors:

> The shift of the vehicle population to newer models will replace the oldest (uncontrolled) segment in the model year mix by newer models (controlled). As an example, CO emissions for these controlled vehicles are approximately 96 percent less than those for uncontrolled vehicles.
>
> The implementation of the BTCP's emissions inspection/maintenance program for all light and medium-duty vehicles is expected to reduce all light-duty vehicle CO emissions by 9 percent and HC emissions by 10 percent.[1]

Figures V-20, V-21, and V-22 present, by year, the total annual emissions of CO, HC and NO_x for the various project alternatives. Predicted emission totals for each alternative experience a significant decrease between 1975 and 1980, and 1980 and 2000. These reductions are due to the effects of Federal and BTCP emission controls. Comparison of each of the alternative build projections with the no-build projection for similar time frames indicates that the total emissions of CO, HC, and NO_x from all build alternatives will be up to 3 percent greater than the emissions for the no-build case. This results from the projected increase in total vehicle miles traveled associated with implementation of any of the build alternatives. Comparison of the various build alternatives in future years reveals less than ten percent difference between the projected emissions of CO, HC and NO_x. Total emissions for Alternative FH-2b are the lowest of the build alternatives and are approximately equal to the no-build case.

5.3.7 Predicted Carbon Monoxide Concentrations and Relation to Standards - Microscale Analysis

Seven cross-sections were selected along the Southwest Corridor as indicators of the change in carbon monoxide concentrations which would occur from construction of the various project alternatives. The cross-sections were located in sensitive receptor areas, i.e., in areas where maximum public exposure to peak CO levels is predicted to occur. The cross-sections are identified in Figure V-23. Detailed modeling simulations were conducted along each cross section for each of the seven impact modeling cases (see Section 5.2.4). The "worst-worst" case was assumed in each instance, i.e., the joint occurrence of peak traffic and most adverse meteorological conditions. The meteorological conditions responsible for high ground-level pollutant concentrations resulting from ground-based emission sources are a shallow mixing depth, low wind speed, and stable atmospheric thermal structure. The specific meteorological conditions chosen to represent poor atmospheric dispersion and dilution of pollutants were a mixing depth of 100 meters, a mean wind speed of 2 miles per hour, and Pasquill's atmospheric stability

---

[1] GCA Corporation, Proposed Transportation Control Plan for the Metropolitan Boston Intrastate AQCR, prepared for the Environmental Protection Agency.

class "D." The 100-meter mixing depth is a typical value corresponding to the top of the turbulent surface boundary layer in an urban area. A mean wind speed of two miles per hour was used as a conservative estimate of worst case conditions. Class "D" represents the most stable ground-level atmospheric stability characteristic of urban areas.

The APRAC-1Amodel was applied to predict 1-hour maximum carbon monoxide (CO) concentrations in the project area. Eight-hour maximum concentrations were calculated using an EPA methodology[1] and air quality data[2] measured elsewhere in Boston. The results of the modeling simulations along each cross-section for each of the seven alternatives are presented in a series of graphs contained in Appendix B. The maximum 1-hour CO concentration predicted along each cross-section for each alternative is presented in Figures V-24, V-25 and V-26 for the years 1975, 1980, and 2000, respectively. Maximum eight-hour concetrations corresponding to the above alternatives are presented in Figures V-27, V-28 and V-29.

The model was applied to predict concentrations using all possible wind directions of a 24-point compass. Because of the complex source-receptor interactions in a large urban environment, no single wind direction produced the worst conditions at all receptor sites. Therefore, the data presented in the cross-section graphs and in Figures V-24 through V-29 are a <u>composite</u> of the highest values at each receptor site.

The impact of the build alternatives on projected CO levels are summarized below for each cross-section. This discussion is limited to a <u>relative</u> comparison of project alternatives. An assessment of the relation of predicted concentrations to air quality standards is given later in this section. For each cross-section, predicted concentrations resulting from a given build alternative in a given year were compared levels noted for a certain alternative are relative to the no-build alternative. Build concentrations differing from the associated no-build concentrations by more than ten percent were deemed to be significant.

<u>Cross-section 1</u> - No significant change in CO levels is predicted to occur in 1975 or 1980 as a result of project implementation. In 2000 construction of Alternatives FH-2, FH-4 or FH-5 would result in an overall 60 percent increase in CO levels.

<u>Cross-section 2</u> - Concentrations resulting from implementation of Alternatives FH-4 or FH-5 would result in a 25-30 percent increase in 1975 and 1980. These alternatives would result in a 92 percent increase in CO levels in 1995.

<u>Cross-section 3</u> - Implementation of Alternatives FH-2, FH-4 or FH-5 in 1975 and 1980 would result in CO concentrations 2.8 times greater than those of the no-build case. In 2000 these alternatives would result in CO levels approximately 3.4 times greater than no-build. Alternatives FH-26 and FH-6 would not significantly differ from the no-build concentrations.

<u>Cross-section 4</u> - Alternatives FH-2 or FH-4 would result in CO concetrations approximately 2.5 to 3.2 times greater than the no-build levels in all three design years. Alternatives FH-2b and FH-6 are not significantly different from the no-build case.

<u>Cross-section 5</u> - Alternatives FH-2, FH-2b, FH-4, FH-5 and FH-6 are 1.5 to 2.5 times greater than the no-build alternative in all design years.

---

[1]Guidelines for Air Quality Planning and Analysis, Volume 9, EPA-450-4-75-001, U.S. Environmental Protection Agency, Washington, D.C.

Cross-section 6 - Implementation of Alternatives FH-2, FH-4 or FH-5 would result in a 12 to 25 percent increase in CO levels over the no-build case.

Cross-section 7 - Implementation of Alternatives FH-2 or FH-4 would result in CO levels increasing by a factor of 2 to 2.5 in all design years.

As noted in previous section, the combined intent of Federal new car emission standards and the Boston Transportation Control Plan (TCP) is to reduce ambient pollutant concentrations below the Federal Air Quality Standards before May 31, 1977, and to maintain these levels once achieved. The effect of these controls, plus the increase in vehicle miles traveled resulting from growth in population and commerce for the project area, is presented in Figures V-24 through V-29 in the form of predictions of air quality resulting from the no-build case. Comparison of the no-build concentrations with air quality standards indicates that indeed no exceedances of the 1-hour (35 ppm) or 8-hour (9 ppm) CO air quality standards are predicted to occur at any of the cross-sections during any of the design years. Predicted CO levels for the build alternatives also indicates no exceedance of the 1-hour standard along any cross-section in any design year. However, predicted 8-hour concentrations indicate that the 8-hour standard will be exceeded at a number of locations throughout the corridor in 1975 (see Figure V-27). By 1980, however, the effects of motor vehicle controls and the TCP result in attainment of the 8-hour standard for all build alternatives and maintenance of this standard through 2000.

The results of this analysis indicate that construction of any of the rail/arterial street build alternatives in 1980 will not interfere with the attainment or maintenance of CO air quality standards.

5.3.8 Parking Facility Impacts

One new parking facility is proposed for the Southwest Corridor. A 500 capacity structure is planned for the MBTA station at Forest Hills. Currently about 900 vehicles are parked (a large number illegally so) in the immediate vicinity of the Forest Hills Station. The illegal parking of motor vehicles along roadways in this area is a problem which adds to traffic congestion. In the past, petitions signed by neighborhood residents supporting the creation of an off-street lot for commuters have been received by the City of Boston. Coupled with the completion of the new off-street parking facility certain existing facilities will be eliminated and can be returned to park use. In addition a program of increased enforcement of parking regulations should be implemented at Forest Hills. Thus, the construction of the new parking facility will not significantly increase existing parking spaces at Forest Hills.

5.3.9 Stationary Source Impacts

Increased service on the MBTA Orange Line, as a result of its relocation in the Southwest Corridor, will require additional electrical power. This additional power will be produced either by one of the existing MBTA power generation station located in Boston, or it will be purchased from the Boston Edison Company. To generate this additional power, more fuel must be burned resulting in increased power plant emissions.

To evaluate the relative impact of this change, an estimate of the increase in Orange Line service was obtained from the MBTA; the predicted daily increase in 684 car-miles. The associated increase in electrical demand is equivalent to the consumption of the additional 87,235 gallons of residual oil at an electrical generating station.[1]

---

[1] "Characteristics of Urban Transportation Systems" Department of Transportation, UMTA, May 1975.

Figure V-30 compares this increase with the average daily fuel use of the MBTA in recent years and the total residual oil burned in the Metropolitan Boston area. The results of this analysis indicate that the change in fuel use will be insignificant compared to the total fuel used in the area. In addition, the pollutants resulting from increased fuel use (sulfur dioxide, SO_2, and the total suspended particulate, TSP) will be emitted to the atmosphere through a relatively tall stack (75-150 meters). This will allow sufficient diffusion of the material so that no measurable increase in SO_2 and TSP concentrations will occur at ground level.

This analysis does not take into account any diverstion from automobile use to the transit facility and is therefore conservative in this respect.

5.3.10 Estimation of Emission Loadings from Land Development in the Southwest Corridor

The purpose of this section is to estimate the stationary source emissions resulting from the development of vacant parcels of land adjacent to the planned transportation facilities. The general approach used was to estimate the emissions from the planned building floor area or number of apartments in each parcel, using a land use based emission factor (tons of emissions per year per square foot floor area). The land use based emission factor is a product of the fuel consumption per square foot of floor area and the emissions per unit fuel consumption.

The development of a set of reliable land use based emission factors is currently the subject of a research study we are conducting for EPA. Therefore, the factors used in this study are provisional, although they do reflect the state-of-the-art. The sources used for the emission factors are:

For residential, retail, and office uses[1]
For light industrial uses[2]
For schools and colleges[3]

In general, it was assumed that residual oil would be the primary fuel for space heating purposes.

Using the planned development on each parcel, low and high estimates for each neighborhood were prepared. These are shown in Figure V-31. Parcels which have alternate uses are shown separately. Using the emission factors, estimated low and high emissions for each neighborhood were prepared. These are shown in Figure V-32 along with the totals for the entire corridor.

To provide a perspective of the impact of the new development in comparison with existing emissions in the area, also presents emissions estimates from the 30 inner cities and towns of Metropolitan Boston. Comparison of the proposed loadings with the regional total indicates that the proposed increase is less than 0.2 percent of the existing emissions for sulfur oxides, particulate matter, and nitrogen oxides and negligible for hydrocarbons and carbon monoxide.

---

[1] Environmental Impact, Efficiency, and the Cost of Energy, Supply and End Use, Volume 1, Hitlman Associates, Inc., November, 1974.

[2] Hackensack Meadowlands Air Pollution Study - Emission Projection Methodology Environmental Research and Technology, October, 1973.

[3] Development of A Methodology to Allocate Fossil Fuel Consumption by County, Walden Research, March, 1974.

5.3.11 Conclusions. The study described in Section 5.2 yielded the following general conclusions.

- A macroscale comparison of total vehicle miles traveled and total emissions of three motor vehicle-related pollutants (CO, HC, and NO_x) for three build alternatives relative to the no-build indicate that all build cases except Alternatives FH-2b and FH-6 would result in an increase in total project corridor emissions. Total emissions for Alternatives FH-2b and FH-6 are not significantly different from those for the no-build case. Thus, of all the build alternatives evaluated, only Alternatives FH-2b and FH-6 are consistent with the State Implementation Plan to attain and maintain air quality standards for photochemical oxidants. It should be noted, however, that this conclusion is a direct result of the specification of an average vehicle speed of 20 mph in the project corridor for existing and future build alternative conditions. In other words, the projected traffic data on which this analysis was based does not show an increase in average vehicle speed in the Southwest Corridor (i.e., a decrease in congestion) due to the construction of an arterial street.

- A microscale analysis of worst case carbon monoxide concentration along the corridor indicate that construction of the arterial will increase CO levels relative to no-build projections. Comparison of predicted CO levels with air quality standards indicate that no exceedances of the 1-hour standard of 35 ppm will occur along the corridor in 1975, 1980, or 2000. No exceedances of the 8-hour standard of 9 ppm are predicted for the no-build case in any design year, and for all build alternatives in 1980 (the estimated year of completion) and 2000. The only predicted exceedances of the 8-hour standard are for an evaluation of the build alternatives in the year 1975. Thus, none of the Build alternatives will interfere with attainment or maintenance of air quality standards for CO.

- Increased power requirements for the relocated Orange Line will be satisfied without significantly increasing the consumption of residual oil by stationary sources in the Metropolitan Boston area.

- Development of land along the Southwest Corridor will not result in significant increases in total residual oil fuel use in Metropolitan Boston. Total emissions of all pollutants will increase less than 0.2 percent if full development occurs.

5.4 Water Resources Impacts

5.4.1 Flooding

In the "modified-embankment" alternative, the existing embankment will be widened to accommodate the proposed rail/transit improvements. The existing pattern of the drainage systems and the quantity of runoffs resulting from storms in this alternative is not expected to change appreciably in comparison to the existing conditions.

Construction of an arterial street in conjunction with this alternative normally would increase the runoff quantities. Because of the elimination of certain paved areas in the new roadway design, however, the change in the runoff quantities (in comparison to the flood discharge capacity of the Stony Brook Conduit) will be negligible. Its influence on the hydraulic characteristics of the conduit will be minimal.

The Arterial, if constructed, would be built with a surface drainage system capable of carrying all runoff away from the transit facility and adjacent residences. The increase in surface area would be less than that lost through the demolition of structures for I-95. These structures will, in part, be replaced with a proposed "Greenbelt" which will also serve to absorb rainfall and minimize runoff. The "Greenbelt" will be designed with its own drainage system containing swales, drainage channels, catch basins, etc., and would be tied to the Stony Brook storm water drainage system.

In the depressed or modified depressed alternatives, the proposed rail/transit improvements will be placed at a lower elevation than the adjacent areas. Consequently the existing drainage systems will be kept unchanged. This will be accomplished by replacing drainage pipes (where they are intercepted by the depressed rail/transit alignment) with the siphon crossings as decribed in subsection 5.2.5.2.

The storm runoff in the depressed area will be collected by a separate system and will be pumped into a suitable outfall structure as found most economical in the final design - probably into the Stony Brook Conduit where it crosses the right-of-way. The quantities of storm runoff discharged into the Conduit in the depressed alternative is not expected to have any appreciable effect upon flow in the Conduit.

The water or "flooding" referred to by one resident at the public hearing in the area abutting the embankment near South Street is a result of a leak in the water supply system and not a display of high ground water in the area.

Coordination with agencies responsible for water quality has occured through the Massachusetts Executive Office of Environmental Affairs, Metropolitan District Commission, the agency responsible for maintainence of the Stony Brook Conduit which traverses the Project area. In her review of the Southwest Corridor Draft Environmental Impact Report (as required under Massachusetts law) the Secretary of Environmental Affairs suggested that the Metropolitan District Commission coordinate its activities in the separation of the currently combined sewer system which serves the southwestern sector of the City of Boston.

In the course of constructing the Southwest Corridor project it will be necessary to create siphons and to relocate portions of the present Stony Brook Culvert. The current Stony Brook drainage system is primarily a storm system, but it inadvertantly includes sanitary waste. The final elevation of the designed depression will not materially change the work required in altering the present culvert. Likewise, the entrance of sanitary sewerage into Stony Brook will not influence the need for relocations to accommodate the rail/transit system.

If Stony Brook Culvert could be completely severed from all sanitary sewer services, it obviously would run cleaner and have better hydraulic capacity. Sanitary sewerage finds its way into Stony Brook Culvert both up and down stream of the limits of the Southwest Corridor project within the large surrounding catchment area.

In looking forward to a long range plan for the separation of storm/ sanitary service by the Commonwealth's Metropolitan District Commission and the City of Boston, it might well be that the Southwest Corridor project could provide for a future upgrading. Given the fact that existing sanitary sewers between Jackson Square and Ruggles Street will be reconstructed by the Southwest Corridor project, the opportunity exists to install, in this limited area at least, new sanitary services.

This initial section of new sewer installed as a consequence of this Southwest Corridor project would be compatible with future systems which eliminate all sanitary inflows into Stony Brook Culvert.

Engineering design in the Southwest Corridor will permit the future separation of sanitary waste from the storm system, with provisions made for the current installation of separate facilities as amy be feasible given the stateoof develepement of an area-wide sewage collection and treatment plan. The Secretary of Environmental Affairs has been advised of MBTA's willingness to cooperate in such matters.

5.4.2 Water Quality

Sediments. Deposition of sediment into the nearby drainage facilities and bodies of water is of great concern to the community in any major construction project. The heavist concentration of sediment in a construction project generally occures where the newly exposed excavation areas are permitted to erode during heavy rainfalls and runoff.

The use of proper erosion and runoff-controlling measures during construction will prevent large amounts of sediment from being deposited into the existing drainage facilities including the Stony Brook Conduit. Without these measures, part of the sediment would be transported to the Stony Brook Conduit outfalls where it would be deposited into the Back Bay Fens Pond and Charles River Basin. The remaining sediment would settle in the drainage facilities, thus reducing their hydraulic capacities and possibly clogging some of the smaller pipes.

Measures to control erosion and siltation as runoff include the installation of setting tanks and the quick covering of regraded areas.

Station Wastes. The sanitary sewage of the stations will be discharged to the nearest existing sewer system. No impact is, therefore, anticipated from sanitary waste from the Stations.

5.5 Prediction and Assessment of Future Noise and Vibration Conditions

5.5.1 Noise Scales and Criteria

The purpose of the noise and vibration impact analysis is to describe the future noise environment that will result if the proposed project is implemented, and to assess this environment both in comparison to the present noise environment and in comparison to standards and criteria. The Southwest Corridor Project involves not only the relocation of the MBTA Orange Line from Washington Street to the present Penn Central alignment, but also the reconstruction of the railroad right of way and the construction of a new arterial street. Eliminating the Washington Street elevated will of course be a great improvement in the noise environment for those who live on or close to Washington Street. On the other hand, implementation of the project could degrade the environment of those who live near the Penn Central alignment. It is the goal of this analysis to quantify the noise impact that is expected to result. The effectiveness of various noise abatement techniques that may be used to minimize this impact is discussed in Section 6.5.

A discussion of noise level scales was presented earlier in Section 2.3.2 on existing conditions. Therefore, only a brief review will be presented here. In general, only two noise level scales are used in this discussion: the peak noise level for a single event, and the energy average noise level for a given period of time. The peak noise level is the maximum reading that one would obtain on a sound level meter, for example, during the passage of a train or truck. It depends on the distance between the vehicle and the observer and the speed of the vehicle. The energy average sound level, L_{eq}, is the equivalent steady sound level that contains as much sound energy as a fluctuating noise during a given period of time. The average sound level also depends on the distance from the vehicle to the observer and the speed of the vehicles, and, in addition, it depends on the number of vehicles that pass during the specified period of time. In this discussion the peak noise level scale is used to describe the noisiness of a single event, and the energy average noise level scale is used to describe the region of impact associated with passage of a large number of trains, trucks or automobiles.

The choice of the sound level scales discussed above is due in part to the choice of criteria by which noise impact will be assessed. Because the proposed project involves not only the rapid transit relocation and railroad improvements and higher frequencies and also the construction of an arterial road, both the Urban Mass Transit Administration and the Federal Highway Administration are involved. UMTA has no specific noise standards or criteria for projects which it funds; FHWA, on the other hand, does have specific design noise levels based on land use categories that must be addressed. Since UMTA has no noise standards, and since the proposed project involves the construction of an arterial road that must be addressed in terms of the FHWA design noise levels, it was decided to also address the impact of the rapid transit portion of the project in terms of the FHWA design levels. Specifically, impact will be noted in residential areas if the estimated average noise level for the loudest hour of the day exceeds 67 dB. If the rapid transit system noise does not exceed L_{eq} 67 dB, then the noise environment is also in compliance with:

1. the standards of the U.S. Department of Housing and Urban Development,
2. criteria for adequate speech communication inside neighboring buildings, and
3. the guidelines of the Institute for Rapid Transit.

An assessment of the project as a whole is also performed in terms of the "Fractional Impact Method", which is presently under development by the U.S. Environmental Protection Agency. In this method a variation of the L_{eq} sound level known as the day-night average sound level, L_{dn}, is used to assess impact. Below L_{dn} 55 dB, there is no impact and for each 5 dB increase, the fraction of impact goes up by 25 percent. For example, if 1000 people were exposed to L_{dn} 65 dB the "equivalent number of people impacted" (ENI) would be 500.

A more detailed discussion of noise impact criteria is provided in Appendix H, where groundborne noise and vibration criteria are also discussed.

5.5.2 Rail Noise Prediction and Assessment

5.5.2.1 Prediction Techniques

This section presents the ingredients and results of the rail noise predictions, and an assessment of these predictions in terms of both present conditons and absoluted criteria. The mathematical method used to obtain the predictions is explained in the technical Appendix H on noise. The noise predictions are for peak hour operations in the design year 2000.

For rail noise predictions, the important parameters are the relative numbers of each car or locomotive type and their corresponding speeds. Sound level information as a function of speed is discussed in

Appendix H. The volume and speed information is presented in Figs. V-33, V-34, and V-34A which show the number of vehicles at various times throughout the day and the maximum speed as function of location between Route 128 and South Station.

During peak hour the MBTA Orange Line is expected to operate at headways of four minutes, that is 30 trains per hour counting both directions. The trains will be six cars in length and the expected maximum speed between stations is 45 mph.

For the predictions it was assumed that all trains will run on welded rail on ties and ballast. In the South End the baseline condition calls for lowering the present alignment by approximately two to five feet in order to get the catenary wires under the bridges.

Noise predictions were made assuming that no special noise control features was implemented. Noise control devices or techniques such as walls at the edge of the right-of-way will be discussed later.

South of Massachusetts Avenue three baseline cases were assumed: the depressed, the embankment, and the modified depressed alternatives. The detail descriptions of the various alternatives studied are presented in Section 4.4. The predictions for the embankment and modified depressed alternatives were based on the assumption that noise barriers were not present. As in the case of the South End, special noise control features will be discussed after the predictions for the baseline conditions are presented.

One alternative that must always be considered in an environmental analysis is simply to do nothing - this is referred to as the "No Build" alternative. Since this alternative exists now, actual noise measurements instead of predictions were used to characterize it. A description was presented earlier in Section 2.3.2 and the predicted noise levels for the build alternatives are compared below. Even without going into detail, it is clear that there is more overall noise impact for the No Build alternative than there is for any of the build alternatives. The passage of a train on the Washington Street steel elevated structure is 20 to 30 decibels louder than is expected if the Orange Line runs at grade on welded rail supported on ties with ballast though the location of the noise is different. When trains run on the steel elevated, the structure itself radiates noise. Although many residences in the South End are very close to the tracks where the Orange Line would be relocated, the present Washington Street alignment is much louder and closer to residences along a greater portion of its length. It clearly impacts more people than the proposed build alignments. This, of course, does not imply that a detailed assessment is not necessary for the build alternatives, but simply that the no build alternative is not the minimum noise impact alternative that it might be for many other projects.

The material which follows indicates those places where impact is expected to occur for the build alternatives. What steps can be taken to minimize this impact are detailed in Section 6.5.

The results of the noise predictions are shown in the form of contours of equal average noise level. Based on the noise impact criteria, the impact occurs when the noise level exceeds L_{eq}67 dB. In terms of the noise contours there will be noise impact within the curve labeled L_{eq} 67 dB unless steps are taken to attenuate the noise.

As points of reference, the noise contours five decibels above and below the criterion, L_{eq} 72dB and L_{eq} 62 dB, are also shown. If the noise level from all trains were to decrease by five decibels the

noise level at the L_{eq} 67 dB contours would decrease by five decibels to L_{eq} 62 dB. Thus, the L_{eq} 62 dB contour shows the impact zone for a five decibel decrease in the noise level. In a similar manner, the L_{eq} 72 dB contour shows the impact zone if the noise levels were to increase by five decibels.

In some cases, one or more of the noise contours stop at a row of houses or a large building. This is because the house or buildings shield the area behind them from the noise. The interpretation in these cases is that the sound level at the facade of the houses or buildings is at least equal to the noise level of the highest level contour that stops there, and that the noise level behind the houses or buildings is less than the lowest level contour that stops at the facade.

In the figures where both the proposed new arterial street and the rail alignment are shown, the noise contours show the combined effect of both of these facilities. The region of impact for the rail facility alone can be seen simply by finding the figures for alternatives that do not include the proposed arterial street.

Rail Noise Levels In The Year of Opening

During the opening year of the proposed project rail volumes will be greater than existing conditions, especially due to the introduction of the Orange Line, but the total volume will not be as great as in the year 2000. For these reasons, noise levels during the opening year may differ from those shown by the contours.

The assumptions concerning train volumes and speeds used to predict noise for the year 2000 are discussed on page 5-71 and Figures V-33 and V-34. In order to compare the year 2000 noise levels with noise levels in the opening year the following assumptions were used for opening year peak hour volumes:

1. The Orange Line will operate at four-minute headways with six-car trains. The maximum speed between stations will be 45 mph.

2. The total number of inbound commuter and AMTRAK trains during morning rush hour will be:

   a. six diesel locomotive trains

   b. six self-propelled diesel car trains (Budd lines)

   c. two electric locomotive AMTRAK trains

3. In peak hour, half of the inbound trains will reverse direction

4. The average train length will be six cars

5. Speeds will be similar to those shown in Figure V-34

Based on these above assumptions, noise levels due to train movements in the opening year will be approximately only one decibel less than the levels predicted for the year 2000. For the portions of the alignment with a new arterial road alongside the rail right-of-way, the noise contours are for the combined noise of the rail noise and the arterial noise. For these portions, and with the rail in the full or modified depression, the arterial road is generally the dominant noise source. Therefore, in the opening year, a one decibel reduction in the rail noise is not significant and the levels as shown by the contours are still valid. For those

portions of the alignment with no new arterial alongside the rail right-of-way, the contours for the year 2000 are approximately one decibel higher than for the opening year. It should be kept in mind that a one decibel difference is insignificant.

5.5.2.2 Impact Assessment

Starting at the northern end of the proposed project, the first residential area near the tracks is the neighborhood to the south of the present Penn Central tracks between Arlington Street and Clarendon Street. Most of the houses that could be affected here are on St. Charles Street or Cazenove Street. This is the section of the rail right-of-way between Back Bay Station and Shawmut Avenue. The Penn Central tracks are paralleled by the Boston and Albany tracks and the Massachusetts Turnpike.

The initial estimates of noise in this neighborhood as shown by the noise contours are for the case where the tracks are not covered. Because the station platforms for Back Bay will extend all the way to Berkeley Street,a deck over the tracks is proposed as a barrier between the tracks and the turnpike to shield both residents and waiting passengers from turnpike traffic noises. A discussion of noise reduction benefits of this deck is provided in Section 6.5 after the discussion of the estimated noise levels without the deck.

The estimated peak hour average noise level at the closest residence due to future rail operations is L_{eq} 77 dB if the Orange Line is at surface, and unshielded. This is a full ten decibels above the impact criterion. However, the existing peak hour average noise is L_{eq} 80 dB due primarily to noise from the Turnpike. If the noise from the Turnpike remains relatively constant in the future, the combined traffic and rail average noise levels at the closest residence will be approximately L_{eq} 82 dB. This is clearly an extremely high environmental noise level for a residential neighborhood.

Of all locations along the Southwest Corridor, the potential for noise and vibration impact is probably the greatest in the South End and St. Botolph neighborhoods between Back Bay Station and Massachusetts Avenue. This area is characterized by row houses which on the north side of the present Penn Central alignment directly abut the right-of-way. This is the side of the right-of-way that is proposed for the relocation of the MBTA Orange Line and increased railroad train frequencies. Southbound MBTA trains would pass within a few feet of the windows of some of these houses and apartments. The problem is further complicated by the fact that most of the adjacent buildings have windows that look down on the tracks from above; consequently, low barrier walls would be useless in keeping the noise from reaching these windows. To build even very narrow walls at the edge of this right-of-way would require at least a minimal taking of property.

The predicted future noise level at the facades of the closest buildings will be approximately L_{eq} 82 dB, which is 15 decibels over the criterion for impact. This is equal to the present peak hour average noise level. The reason the future average noise level will be approximately equal to existing conditions despite a large increase in train volumes is due to the combination of using good welded rail and electrification. Also, by the year 2000, all remaining diesel locomotives will be in compliance with the new EPA noise regulations for locomotives.

As an example of how the average sound level works, a three decibel increase in the maximum noise level of all vehicles is balanced by a doubling in the number of trains, and a ten decibel decrease in the maximum noise levels of all vehicles is balanced by a ten-fold increase

in the number of trains. Even though the average noise level is not expected to increase, it is recognized that the predicted future sound levels exceed the criterion by approximately 15 decibels and that steps should be implemented to minimize this impact.

If no measures are taken to abate noise, the region of impact in the South End and St. Botolph areas, that is the distance of the L_{eq} 67 dB contour, would be 200 feet on both sides of the tracks. Approximately the first ten houses on each side of each street on both sides of the rail right-of-way would be impacted. The number of these houses is approximately 325.

One solution proposed as a means of eliminating the noise impact in the South End is to lower the rail grade approximately four to five feet below the present grades, construct walls at the edges of the right-of-way and cover the rail area with a lightweight deck.

One problem with this solution is that such a decking structure would block the windows providing light and air to a number of rooms along the right-of-way. This could require the acquisition of the apartments involved, blocking off the windows, and converting the rooms and/or apartments to other non-residential uses as a method of overcoming the problem. Another possible solution to blocking off the sunlight would be to put gaps in the wall and deck adjacent to the windows. The noise level at such gaps would be at least as high as without the walls and deck. To combat this, windows near the gaps would need to be soundproofed and extra sound-absorbing material would be needed inside the tunnel. This would lower outdoor noise levels overall and would protect individual rooms. As housing was rehabilitated, windows could be blocked and the deck made continuous.

Soundproofing in general would consist of installing commercially available double glazed windows. (This was done, for example, at the University of Massachusetts, Columbia Point, which is directly under a flight path of Logan Airport.)

The walls and deck solution would solve the airborne noise problem in the South End and St. Botolph areas. Inside this tunnel the sound level would be about 10 decibels higher than it is for train operation above ground in the open. This is due to the reverberant build up of the sound inside a confined space with hard walls. If the walls and deck have a sound transmission loss of 40 decibels, the sound level of a passing train would be less than that of a low speed automobile. A transmission loss of 40 decibels can be achieved with walls and deck made of four inch thick dense concrete. This would satisfy the L_{eq}67dB criterion by more than 15 decibels, if the deck were complete and would provide an overall level below the criterion if it were not.

Ventilation shafts may be necessary at a few locations between Back Bay Station and Massachusetts Avenue. These shafts should be acoustically treated or the sound radiated from them will be as loud as a passing train without the deck. Acoustically treated ventilation shafts are commonplace in newer transit systems such as BART and Washington METRO and, therefore, they do not present a design problem.

5.5.2.3 Vibration and Groundborne Noise

Potential vibration and groundborne noise impact along the proposed corridor is primarily a problem in the South End and St. Botolph neighborhoods. Some of the residential structures here will be within ten feet of the closest Orange Line tracks. Future vibration levels at these locations were estimated from examples found near the MBTA Red Line extension to Quincy. In the frequency range below 30 Hz (cycles per second) the Red Line vibration levels were approximately equal to the threshold of perception. This is probably better than existing conditions in the St. Botolph and South End areas; the main difference being that welded rail is used on the Red Line extension and bolted rail

is used for the present Penn Central alignment. (The reader is referred to the "Appendix H" on Noise for a further discussion on the vibration impact criteria.) In this frequency range, below 30 Hz, the only vibration abatement techniques that work well are keeping the wheels trued, the rail ground and using compliant resilient rail fasteners. If these techniques are used, vibration levels can be kept below the threshold of vibration perception. Techniques such as "floating-slab" track beds only work at the higher frequencies discussed below.

The stiffness of the fasteners under load must be 75,000 to 100,000 lb. per inch or less to work effectively. The Toronto Transit System has used such fasteners for several years with good success. Rail discontinuities, such as cross-overs and insulated signaling joints should not be placed within 100 feet of noise and vibration sensitive sites including residences.

Ground vibration in the frequency range above 30 Hz can vibrate the walls and floors of nearby buildings and cause them to radiate an audible rumbling noise. Again, wheel truing, rail grinding and the use of resilient rail fasteners are the first steps to solving this problem. Ballast is also useful in reducing groundborne noise. However, even wheel truing, rail grinding, resilient rail fasteners and ballast probably will not solve the groundborne noise problem at the closest windows. If a concrete slab track bed is used in the St. Botolph and South End areas, then good vibration isolation should be provided between the rails and the slab. The types of solutions that should be considered are: (1) "floating slab" track beds; (2) resiliently isolated double ties; (3) STEDF type ties, or (4) isolation mats such as neoprene, covered with ballast. If an acoustic deck is not built, then a solution that keeps the ballast for sound absorption is preferable.

A more thorough study of the groundborne noise problem should be conducted in the preliminary engineering design stage of this project. This study should include simultaneous vibration measurements near the tracks and inside the closest windows. This information can then be used with vibration level measurement from trains on welded rail to more accurately predict interior noise and vibration levels in order to design adequate measures to control noise and vibration levels. (See Section 6.5). These measurements should be accompanied by strain measurements at key areas to monitor building movement, if any, as the result of construction and operations.

The solution to the groundborne noise problem depends to some degree on the solution to the airborne noise problem. It does not make sense to spend a lot of money trying to attenuate noise from one path without attenuating noise from the other path. Whatever the degree of noise attenuation that is desired, the money is best spent if the remaining noise from the two paths is approximately equal.

5.5.3 Arterial Street Noise Impact

5.5.3.1 Prediction Technique

This section describes the noise associated with the arterial road portion of the proposed project. The Federal Highway Administration, in response to the Federal Highway Act of 1970, has specified the noise impact assessment procedure for projects which they fund. This procedure was first specified in Policy and Procedure Memorandum 90-2, and it has been recently updated in Volume 7, Chapter 3, Section 3 of the Federal-Aid Highway Program Manual (FHPM).

Some aspects of the new 773 version not contained in PPM 90-2 have been used in this analysis. The 773 version permits the use of either the L_{10} sound level scale or the L_{eq} sound level scale. The L_{10} sound level is that sound level that is exceeded ten percent of a

specified period of time; it was the only scale authorized in PPM 90-2. In this analysis the L_{eq} sound level, the equivalent steady sound level, was used to specify the area of impact. This scale was used so the combined effect of roadway and railway noise could be predicted. It would not have made sense for the L_{10} sound level scale to be used, because L_{10} is a poor measure of events, such as railway noise, that occur less than ten percent of a given time period.

Only two noise prediction techniques are permitted by FHPM 773: the method contained in National Cooperative Highway Research Program Report 117 and the computer method described in Department of Transportation Report DOT-TSC-FHWA-72-1. Of these two methods, only the computer method can be used to determine the L_{eq} sound level. It was therefore used for this project.

Based on experience gained on similar projects, it was noted that the authorized prediction methods tend to overpredict truck noise on urban roads. This is because these prediction models were primarily designed for free flowing high speed highways and not low speed urban roads. It was, therefore, decided to modify the computer model for low speed trucks; the FHWA said they would approve this modification, if supporting data were provided. Therefore, during the course of this analysis, the noise emission level of more than 100 trucks on Boston streets were measured. The results of these measurements are presented in the Technical Appendix H on noise. Based on data that was obtained and the approval of FHWA, a reduced noise emission level for trucks was used for the arterial road noise predictions.

FHPM 773 states the volume of automobiles used in the predictions should be the lesser of the design hourly volume or the maximum volume under "level of service C" conditions. This choice corresponds to the worst noise conditions for automobiles. For the proposed arterial streets, the design hourly volume exceeded level of service C, therefore, levels of service C volumes for automobiles were used in the predictions. The design hourly truck volume was used for truck noise predictions as required by FHPM 773.

The FHWA standards required that the noise for the loudest hour of the day not exceed the appropriate "Design Noise Level". The Design Noise Levels are based on the sensitivity of the activities and purposes for which the land is used; these design levels and the corresponding land use categories are listed in Figure V-35.

In addition to the Design Noise Level standards, the FHWA also requires that the estimated future noise be compared with the existing noise environment. The purpose of this is to determine if there will be a significant increase or decrease in the ambient noise level. For this reason, an ambient noise measurement program was conducted. The results of these measurements were discussed earlier on the section on existing conditions (Section 2.3.2), and the data at each site is presented in Appendix H on noise.

5.5.3.2 Impact Assessment

The extent of the noise impact for the arterial is shown by the noise contours. In general , the contours presented are for the combined noise from the rail operations as well as the arterial road.

In open areas, the region of impact - that is, the distance to the L_{eq} 67 dB contour - is approximately 130 feet from the near edge of the arterial where it is six lanes wide and 90 feet where it is four lanes wide. In general there are no problems with impact because the area that is cleared is larger than 130 feet on either side of the proposed alternate railways.

5.5.4 Comparison of Noise Levels by Alternative

Noise monitoring of existing rail and street facilities was accomplished during the performance of the analysis and is documented in Figures H-1 to H-12 in Appendix H. In addition, projections of noise levels were made for the year 2000 and are also shown at 3 levels (62, 67 and 72 dbA) in plan illustrations for all alternatives.

5.5.4.1 Roxbury and Jamaica Plain Noise Levels

In Roxbury and Jamaica Plain the effects of the modified depressed alternative upon these noise levels are clear upon examination of plan illustrations for this alternative. Comparisons with the other alternatives are also useful in an evaluation of the incremental utility of each alternative beyond the base case of the Embanked Alternate.

This analysis reveals the following noise levels (db eg A for the peak hours) at key receptors along the Corridor as shown in Figure V-35A.

The MBTA has drawn a new profile, the "Post Hearing Profile" for the proposed elevations of the railroad/transit/arterial corridor. This profile would produce noise levels similar to those in the fully depressed profile at the above-listed sensitive receptors. Fill slopes would provide noise barriers that are the equivalent in reflective value to the full cut described in the fully depressed alternative. In no case would noise levels be greater than in the "modified depressed" alternative. These noise levels are considered acceptable according to standards derived in this Environmental Impact Statement (see pages H-5 and H-6 of Appendix H and as shown in Figures IV-49 through IV-60).

5.5.4.2 Arterial Noise Impacts

This Environmental Impact Statement discusses both peak (or maximum) noise levels and average noise levels (L_{eq}). The peak noise level during a given period of time is just the highest level one would read on sound level meters. For traffic noise, it would probably be due to the passage of a loud truck or a motorcycle. Peak noise levels in Jamaica Plain from traffic will be approximately the same whether or not the arterial is constructed.

The average noise level, L_{eq}, which is the noise level scale that was used for the noise contours, depends not only on the noise level of individual vehicles but also the number of vehicles that pass in a given period of time. The average noise level is the equivalent steady noise level that contains as much sound energy as the fluctuating sound level. The peak sound level is used to describe the noisiness of a single event, and the average noise level is used to describe the noise environment or climate.

If the traffic on a road is doubled, the total sound energy is also doubled. However, because the sound level is proportional to the logarithm of the sound energy, the average sound level only increases by three decibles.

If the arterial is built in Jamaica Plain, the traffic volume along what is now Amory Street would increase from about 7000 vehicles per day to about 24,000 vehicles per day. The corresponding increase in the average noise level would be approximately five decibles. This is a large enough change to be clearly noticeable. On the other hand, it is expected that construction of the arterial in Jamaica Plain would reduce traffic on Lamartine Street from about 7000 vehicles per day to 300 vehicles per day. The corresponding reduction in the average noise level would be approximately 13 decibels.

Construction of the arterial street would lead to a redistribution of traffic and consequently a redistribution of the traffic noise. Clearly the areas directly adjacent to the proposed arterial would notice an increase in the average noise level, and areas not adjacent to the arterial would notice a decrease.

5.5.4.3 South End/St. Botolph Rail Noise and Vibration

Subsequent to the Public Hearing on July 15 and 16, 1976, revisions were made in the South End/St. Botolph Neighborhoods. The entire area from Dartmouth Street to Massachusetts Avenue will be covered by acoustic decking . That is, this length will have a continuous noise wall with a continuous acoustic deck. Revisions to the windows in existing buildings will be made to allow such a cover to be installed upon project completion, rather than leave this option for the future.

Covers to be located between Dartmouth Street and Yarmouth Street and between Albemarle Street and Massachusetts Avenue will be constructed of materials that can be removed and replaced upon the development of air-rights at such locations. A noise barrier will be continued at the Massachusetts Avenue Station so as to protect the projected renovated housing adjacent to the tracks and the housing development sites to the north from excessive noise levels.

Vibration levels are treated in Appendix H, pages H-2 and H-3. It is expected that new vibration levels will be below current levels.

In the earliest construction phase of the project, photographic surveys will be made, and strain gauges will be installed at critical locations in the St. Botolph and Back Bay areas. Such documentation will be used in the determination of pre-construction conditions for use in evaluating any claims for damages which may result from construction or operation of the new facility.

5.5.4.4 Public Discussion of Noise Impacts

Numerous meetings with abuttors to the proposed Southwest Corridor Project have been held during the execution of the Enviornmental Impact Statement. The St. Botolph/South End Task Force was composed virtually entirely of abuttors living adjacent to the constructed rail right-of-way, they helped the Authority develop standards for noise levels as well as the project description for their neighborhood.

Several Neighborhood Committee meetings in the Roxbury and Jamaica Plain areas have dealt with noise impacts. These committees are composed of abuttors to a very large extent (residents from Whittier Street, Mission Hill and Bromley Heath Housing Developments in Roxbury as well as home owners and renters from Jamaica Plain); and it is clear from the testimony offered at the July 15, 1976, Southwest Corridor Public Hearing that they are well informed about the proposed project.

Testimony and attendance at the June 24, 1975, Public Hearing on the Midland Reconstruction and Acquisition Project and meetings held subsequent to that Hearing indicate that abuttors to that project are also informed.

As a result of the analysis of projected noise impacts along the Midland Division, as well as of several meetings between the Southwest Corridor and community organizations and their representatives noise alternative measures are proposed as part of that project.

5.6 Economic Development and Community Impacts

This section explores the respective impacts on economic development resulting from the two basic courses of action available: (1) allow existing conditions to continue, and (2) develop instead, a depressed rail-arterial road system in the Southwest Corridor. While other alternatives exist, their place on the scale of economic impacts will be found somewhere between the impact levels established by these two basic cases.

5.6.1 Continuation of Existing Conditions

The advantages and disadvantages of investment in a rail/transit arterial road project in the Southwest Corridor can only be assessed against the background of existing conditions, i.e., what would the future be without the new investment project. This course of action means that Orange Line service would be continued along the Washington Street elevated structure with stops as presently constituted. Automobile traffic would continue to use the combination of existing streets[1] for access to their destinations. Railroad traffic would increase with Amtrak and commuter rail service improvements on the existing embankment.

While short term safety and aesthetic improvements to the elevated structure will be made by the MBTA, they will not alter the basic impact of the structure on the Washington Street area. The unsightly presence of the structure, the unmitigated noise of passing trains, the poor light exposure of adjoining areas as well as the difficult traffic conditions created on the street below, have all combined to depress property values and greatly limit the redevelopment of the area. The deteriorated state of adjacent buildings as well as that of the local environment can be directly attributed to the existence of the "EL". Given a healthy mortgage market, the removal of the structure can be expected to initiate a general renewal trend in the Washington Street area, and a gradual return to its former state as a healthy residential and commercial street. The South Cove Urban Renewal Plan, for instance, anticipates the removal of the elevated structure in order to create a new development parcel for the Tufts New England Medical Center and associated new housing.

While depressed by the existence of the "EL", the communities through which it passes are not provided adequate transportation service by the system. The location of stations with wide spacing (up to 3/4 of a mile) is such that large sections of the community are left unserved. In the South End, the area around the Cathedral Housing Project has no station, nor does a station serve the new and existing housing and industry in lower Roxbury. Specifically, in Roxbury, the long distance between Dudley and Egleston leaves the Highland Park, Washington Park, and Bromley-Heath areas poorly serviced. The western part of Jamaica Plain is also not well served due to long walking distances to station stops at Egleston and Green Street.

Transverse bus service between the communities and the station stops on the present Orange Line is irregular, with as much as 30 minute waiting time between buses. In addition, free transfer between the bus and Orange Line is not provided. While the improvement of bus service is possible without the removal of elevated structure, the present level of street congestion caused by the structure makes any major improvement, such as exclusive right-of-way service, virtually impossible.

The removal of the Orange Line from its present location would reduce aspects of service to portions of the two communities it now services: South End and Roxbury. The provision of satisfactory replacement services are important to the neighborhoods' transportation system.

---

[1] Washington St., Columbus Ave., Tremont St., Sterling St., Ruggles St., Albany St., and Hampden St.

The base, or worst, case involving removal of the elevated would, however, consist of replacement of its service with revised bus service at frequent headways running the length of Washington Street from Downtown to Dudley Station. This base condition could easily be provided as an "exclusive right-of-way service" for its entire length if the City of Boston is able to implement its Washington Street Mall in the Downtown shopping district. The provision would provide adequate access to commercial businesses located on the street which now rely in some way upon high frequency access. It should be noted, however, that the provision of fixed rail transit service on Washington Street between the Downtown subway and Dudley Station has the potential of increasing the overall commercial viability of the street well above the existing and base cases because of the known preference of commercial markets to be near a modern surface rail facility. This service, if further extended southward, would have superior ability to enhance commercial strength because of the ability of passengers to view these commercial establishments from the vehicle but also to approach them more conveniently at a close light rail station spacing of about every second block. At Dudley Station itself much of the commercial district is some distance from the station. Distances of as much as 10 minutes walking time to the edge of the commercial area from the upper level platforms are now encountered.

It is projected, as a continuation of the current trend, that by 1980 ridership at existing Dudley Station will have fallen by about 10 percent and that approximately 75 percent of the boardings at the station will continue to be by passengers arriving by bus.

These passengers, because of the station's internal configuration and circulation pattern are not exposed directly to surrounding commercial uses. There is some evidence that indicates that few if any passengers transferring from the Orange Line to a bus use the stores in Dudley Square. Rather, it would appear that shoppers in the area primarily make purchases as the result of deliberate trips to the area for that purpose. These trips would be also accommodated by convenient bus routes through the square.

The physical presence and blighting influence of the "EL", which is both noisy (noise levels of up to 100 dBA on the ground) and dirty and keeps the Dudley Square area in darkness, and seriously impedes traffic flow, as well as problems of a local nature (parking, security, loss of local surrounding resident population) have caused great harm to the local economic climate for business. Removal of the EL, routing of convenient bus routes through the area (see Feeder Bus Systems, Section 5.1.4) traffic and parking improvements as planned by the City, and a concentrated effort to provide good coordination of merchant activities (as currently being pursued by the Dudley Merchants Assocation) should provide the most beneficial uplift to business. The surface replacement service would further raise the level of this uplift well between the current situation.

In spite of its present location at an Orange Line Station, Egleston Station has already lost most of its commercial base. In the Relocated Orange Line alternative bus routes would continue through Egleston to the Orange Line terminating instead at Jackson Square (see Fig. V-4).

As a consequence, the impact resulting from the removal of the station would be very limited. Provisions by local merchants for parking, street lighting and other improvements would more than offset these limited Orange Line impacts.

The relocation of Green Street Station one block to the west will have little impact on access to both businesses and residents. Removal of the "EL" will improve driver perception on Washington Street and general attitudes about the quality of the area. These factors should more than offset the small inconvenience of extra walking distance (about 800 feet).

Without the relocation of the Orange Line, the land cleared for the now withdrawn segment of I-95 South, would have little re-use potential and would continue to act as a negative influence upon the communities of Jamaica Plain and Roxbury. The re-use value of such vacant areas as well as that of adjoining vacant or underused privately owned parcels is dependent upon the provision of proper transit and motor vehicle access.

5.6.2 Development of the Rail Transit and Arterial Road System

Section 2.2.2.8 described the communities served by the realignment of the Orange Line to be characterized by high concentrations of unemployment. Perhaps the most important impact of the relocated Orange Line would be to make the core city more accessible for the inhabitants of these communities. This in effect, would increase the number of jobs available to them. This relative increase in turn, signifies an increased labor pool and consumer market for core city service organizations. Thus, the relocated Orange Line will tend to strengthen the concentration of service related activities in Boston's core while at the same time improving the job accessibility of the lower income segments of the City's population concentrated in communities adjacent to the new alignment. In addition the access provided to the commuter rail system at Ruggles Street and Forest Hills will provide "reverse" commutation opportunities to suburban locations from which bus connections could be provided to the 128 industrial park belt. Fig. V-36 demonstrates this increased accessibility. to transit station and commuter rail stops from specific public housing projects. Note that while the present Orange Line does not provide direct service to a single public housing project, the new relocated alignment offers direct service to the Whitter St., Mission Hills, Mission Hills Extension, Bromley-Heath, and Academy Homes projects.

New activities can be expected to develop within the communities transversed by the realigned Orange Line. New retail, service, and housing facilities will aggregate near the new station stops. The consolidation of the existing road system made possible by the proposed arterial street will make possible the regrouping of small parcels into larger more economic building sites. This parcelization of land and joint-development at stations is a major determinate of the Southwest Corridor Plan.

While the transit program can be expected to provide greater job accessibility for low income residents, to strengthen the service orientation of the core city, and to generate redevelopment in the communities transversed by the system, it alone will have little effect on the regional distribution of the City's population. In all probability it will neither strengthen nor reduce the long-run trend of migration out of the central city.

During the construction phase of the proposed relocated Orange Line, regional employment and income will experience short term (5 to 6 years) gains. Since the required work force will be large, the increase should assist in alleviating the growing unemployment in this sector, as described in Section 2.2.2.8 of this report. Section 7.3 examines in detail the impacts of construction investment.

Fig. V-37 summarizes the economic impact of the Southwest Corridor on the City of Boston as estimated by the Boston Redevelopment Authority Research Department. This table includes both construction and permanent jobs created by the transportation and land use elements, as well as the revenues to both city and state.

5.6.3 Effect of the Proposed Project on Property Values

The precise effect of the project on property value is difficult to estimate due to the high variability of very specific existing influences on particular parcels of property. It is possible, however, to present qualitative judgements of the overall effect of the project.

Inasmuch as the first concern of the real estate appraisers is neighborhood location and environment, the impacts of the removal of the Washington Street Elevated (in the South End, Roxbury and Jamaica Plain) and the Penn Central embankment (in Jamaica Plain and Roxbury) would be beneficial to property values for the whole of each of the neighborhoods involved. Historically, values adjacent to such structures is lower than that of those located in areas outside of the immediate zone of the influence of noise and vibration, yet which are within the zone of higher accessibility permitted by the facility.

The consolidation of fixed heavy-rail facilities in the South End and Jamaica Plain in one corridor should increase property values for the neighborhood as a whole since these facilities now impact more than one area of each of these neighborhoods. The construction of the Southwest Corridor arterial street would result in the lessening of traffic on Columbus Avenue north of Ruggles Street and on Massachusetts Avenue in the South End. The arterial would reduce the amount of traffic on some residential streets and, therefore, its construction would be an incentive to higher property values for these local areas as well as the neighborhood as a whole.

In Roxbury and Jamaica Plain, better access to the cleared land parcels by transit and/or arterial and the additional attractiveness caused by creation of the Green Belt and removal of the embankment would increase the changes of development of these parcels, and therefore, value is much reduced without this access.

While the appropriate level of adequacy is hard to determine, in all cases, the provision of noise abatement measures is essential to the preservation of the value of existing habitable properties which directly abut the transit and rail facilities. Without such measures, value will probably decrease to some degree, though in this case, such properties are already of diminished value since they currently abut a major rail facility. If perceived noise levels remain the same or can be improved, values should not diminish significantly.

5.6.4 Local and Neighborhood Project Impacts - South End, South Cove, Back Bay, Fenway and Saint Botolph Neighborhoods

The proposed alternatives will have both primary and secondary impacts on the local community. Primary impacts are those effects immediately related to the rail facilities. These include transportation service to local residents, relocation of business or homes, changes in traffic and circulation patterns (both pedestrian and vehicular), disruption of community facilities, and some fiscal effects. Secondary impacts are more wide-spread and less easy to predict. They encompass changes such as alterations to development patterns and employment over the long term, and concomitant changes in social characteristics, neighborhood quality, and fiscal position (Sec. 6.6, Adverse Community Impact).

Between South End, South Cove, Back Bay, Fenway and Saint Botolph neighborhoods, major physical changes would take place at the two proposed station locations - Back Bay and Massachusetts Avenue' The Penn Central tracks are depressed between the communities, and will remain depressed with the new Orange Line tracks. Bridges over the right-of-way will be reconstructed to accomodate the new rail facilities at the following street crossings: Berkely Street, Clarendon Street, Dartmouth Street, WDst Newton Street and Massachusetts Avenue.

The Back Bay reconstruction is of major significance to the neighborhoods, becuase it would provide a major interconnection between the new rapid-transit line, and commuter-rail/Amtrack services. Access to the station for vehicles and pedestrians is therefore of prime consideration to the communities. It is anticipated that the present street pattern would be slightly altered on the bridges to permit improved access to the station. Existing one-way flow of traffic on Clarendon Street would not be altered. Station design would need to provide for access from both Clarendon and Dartmouth Streets.

Extensive realignment of tracks and platforms is contemplated for Back Bay Station. This means that the construction area will be somewhat wider than present trackage. This involves the acquisition and demolition of approximately eleven properties adjacent to the existing tracks - seven residential properties and four commercial properties. Only five of the seven residential properties are occupied for residential purposes, and two of them are completely vacant. One of the commercial structures is a one story metal shed used for dead storage adjacent to a larger primary structure. No other property takings would be required for the project. Relocation of the occupants of these structures would be an integral part of the construction program. Construction for the new Back Bay Station would take place within the modified right-of-way provided by property acquisition and the use of the right-of-way of Buckingham Street, which would be replaced over the rails upon completion of the project.

At Massachusetts Avenue, the project will include a station to serve the area of Symphony Hall, the Christian Science Center, the Boston Arena and the heavily used Massachusetts bus corridor. Symphony Station on the Green Line is close to the proposed alignment at this location and will be linked with the Relocated Orange Line with pedestrian connections at the surface. Bus access will be closely linked to both transit facilities, through provision for boarding and alighting on Massachusetts Avenue at both stations. Alignment restrictions probably dictate that the station be end-loading from Massachusetts Avenue. A pedestrian underpass on the northbound side of Massachusetts Avenue would be provided for direct access to the station. Another pedestrian bridge, over the rail facilities, would be provided at Camden Street with stairways to the station and the Boston Arena.

Development sites along this portion of the railroad right-of-way are somewhat limited due to intensive existing development. It would be possible to provide for air-rights construction over the tracks, in conjunction with noise barriers and decks, should that be desirable. Most of the probable development would take place adjacent to the tracks. One parcel at Massachusetts Avenue, which is presently vacant, could be developed immediately. However, significant development in the vicinity of Back Bay Station may occur on adjacent lands, stimulated by the construction of the proposed intermodal interchange at that location.

The Orange Line will provide a supplement to the service provided to the growing Back Bay business district by the Green Line Huntington Avenue trolley. The rapid increase of office space in the area in the recent past as well as the completion of the John Hancock Building will create further demand for transit service in the area.

No parking facilities are included in the alternative schemes adjacent to stations at Back Bay or Massachusetts Avenue. Care should therefore be taken to prevent motorists from parking in residential neighborhoods and then riding on the new facilities. This could be accomplished through signing of parking restrictions and adequate enforcement of existing and new parking regulations. Local streets leading to transit stations should also be provided with significant restrictions to prevent heavy volumes of traffic from using residential thoroughfares. Principal impacts on local streets would occur on the streets crossing the proposed right-of-way, and on certain north-south arteries leading toward stations, including such streets as Columbus Ave., and Tremont Street in the South End, and Huntington Avenue in Back Bay, and the Fenway. Revisions in the roadway widths and overall design of both Columbus and Tremont Streets have been in planning for some time, and should result in partial control of volumes which can safely traverse the South End. Huntington Avenue is also the subject of proposed improvements which would have the net effect of creating safe vehicular operations in an area which is not heavily residential.

No recognized individual buildings of historic significance, national or local, would be directly affected by the proposed alternatives. The South End is, however, comprised of a great many older homes, built row-house fashion and similar to the character of Beacon Hill and Back Bay residential neighborhoods. This area, which has been designated a National Historic District since May of 1973, has had substantial urban renewal activities to upgrade the housing stock and related community facilities. The proposed alternatives that include sound attenuation devices, landscaping and adequate urban design measures in all new construction should protect the character of the historic areas; the alignment would be depressed below surface grade, landscaping and high quality fencing would be provided, and stations are located in areas which are present nodes of heavy activity. (Refer to the review of Historic Properties in Appendix A.) Additionally, no community facilities would be impacted and only one public school is adjacent to the right-of-way. The existing school, which is a temporary structure, will be removed when the permanent Carter School is constructed a block away from the right-of-way.

5.6.5 Local and Neighborhood Project Impacts - Roxbury - Mission Hill

The proposed Relocated Orange Line would run between these communities in the area between Ruggles Street and Jackson Square. In this area, community impacts can become significant in the range of alternatives. This discussion centers upon the extremes of that range - the modified embankment and the fully depressed. See Section 4.3.1.5.4 for a comparison of all alternatives.

The proposed Relocated Orange Line would run between these communities in the area between Ruggles Street and Jackson Square. In this area, community impacts can become significant in the context of the two alternatives - the Modified Embankment and Depressed Rail Facilities.

The Modified Embankment alternatives would retain and alter the existing embankment for improved transportation service. Retention and modification to the embankment would result in significant impacts. First, the existing visual barrier would not be removed, but would in fact be enlarged in both vertical and horizontal dimensions. The addition of a continuous noise baffle along the top of the modified embankment would elevate its perceived height some 8 to 11 feet while at the same time reducing the potential noise impacts. The widening of the embankment would result in a larger physical separation between communities than presently exists. The cross streets passing under the embankment would be wider than at present, affording some degree of safety for pedestrians crossing the alignment and reaching the rapid transit stations. The net effect, however, is of an enlarged structure passing between neighborhoods. Secondly, the enlarged embankment would conceivably impact the marketability of the vacant land created originally for the expressway. The presence of the structure, even with noise reduction measures, may act to depress the utility of specific sites along the rail line, which would otherwise be more visible and useable for potential development. Thirdly, the reduction of noise through the use of noise baffle walls atop the embankment will not reduce the noise impact for those high structures which are located close to the embankment. While this is also true of the Depressed Rail alternative, there are few ameliorative actions that can be taken beyond provision of the wall in the Modified Embankment scheme. In the Depressed Rail scheme, by contrast, it would be possible to deck over seriously impacted areas, to totally eliminate the noise sources from affecting adjacent properties.

For both the Modified-Embankment and the Depressed-Rail alternatives, station locations in these communities would have improved access to adjacent neighborhoods. The station at Ruggles Street would serve the adjacent high-density publicly subsidized housing projects, as well as Northeastern University and the northern portion of the Campus High School. With the development of the cleared lands, the station would serve not only existing adjacent land uses, but several high-density uses proposed for adjacent sites. The Ruggles St. station, in the future, could become the intersection of the Relocated Orange

Line, several realigned bus routes and the proposed cross-town circumferential services. This station will serve as a new focus for the heavily used bus services which now terminate at Dudley Square.

The station at Roxbury Crossing serves adjacent neighborhoods and the Campus High School. Bus shuttle service into the medical insitution area near Huntington Avenue could be effected from this location with additonal bus services connecting into Brookline and the Arborway and Riverside Green Lines. Some of these considerations are also true for the proposed station at Jackson Square, which serves not only portions of Roxbury and Mission Hill, but also the northern reaches of Jamaica Plain. Adjacent to Jackson Square are several large housing complex sites, most notably the Bromley Park and Heath Street projects. Bus service would reach the station from the Franklin Park area and from portions of Jamaica Plain and Mission Hill. The extension of Martin Luther King Boulevard, if implemented, would provide an additional route for bus services from the Washington Park area into Jackson Square Station.

Construction of new stations at Roxbury Crossing and Jackson Square would provide new impetus to development of the cleared lands of the corridor. In the Modified Embankment alternatives, however, the available parcels may be difficult to market because of the enlarged embankment. In the Depressed alternatives sites could be developed in conjunction with the rail stations, and perhaps could utilize certain portions of the air rights over the rails, if that becomes desirable. The available sites in the depressed-rail plan should be somewhat enhanced by the partial raising of grade and disposition of spoils which would elevate portions of the sites to grades more suitable for aggregation into large parcels for development. The Modified-Depressed alternatives require the raising of the grades of streets as they cross the rail/transit alignment to produce the required clearance above the tracks. This will cause cross streets to hump up, resulting in some visual discontinuity as one looks along the street. The Modified-Depressed alternatives also require further takings resulting from raising street grades near some buildings. Development opportunities are similar to those of the Depressed alternatives. Careful layout and disposition of lands should accommodate the one historic structure in the area - the Dudley House at 167 Centre Street.

Construction of a new arterial street would allow an increase in size of the cleared-land parcels to the east of Columbus Avenue. Construction of the street over the depressed relocated Orange Line between Roxbury Crossing and Jackson Square would allow a further substantial increase in the size of the development parcels that are located to the east of Columbus Avenue.

5.6.6 Local and Neighborhood Project Impacts - Jamaica Plain

Jamaica Plain would have four stations serving it instead of the present three. The new stations would be in the Penn Central right-of-way in which most of the available developable parcels in the neighborhood are located. Improved inter-modal connections at Forest Hills would expand transportation options for residents and would make the neighborhood more accessible to the region for purposes of recreation, shopping and employment.

Bus terminal facilities would be improved and a better connection of the Green Line to bus and Orange Line at Forest Hills would encourage ridership on the rapid/transit lines. Increased ridership at the southern end of the line would balance passenger loadings and encourage service improvements which would be generally beneficial.

Removal of the Washington Street elevated would have beneficial effects on most of the land uses along the street. Improved environmental conditions would be conducive to residential rehabilitation and new development. There would be a loss of business for some retail activities located at stations, however this would be offset by retail demand created at the new stations.

Local street congestion will worsen near the new stations while Washington Street congestion will be eased at Green Street and Egleston Square. Jackson Square and Forest Hills will be substantially changed, greatly improving them both functionally and visually. On balance, the neighborhoods will greatly benefit from environmental and traffic improvements around the stations. The plans for Green Street and Boylston Street Station incorporate minor traffic improvements in their immediate environs. Traffic densities on surrounding streets will increase because of station traffic. On-street all day parking by commuters will be a problem near the new stations just as it is now at Forest Hills. Increased enforcement, metering and a resident-sticker program are recommended to control this. A small commercial lot is planned at Green Street to replace the one now operating at the old Green Street Station. The Forest Hills Station is planned to incorporate a commercial parking structure accomodating between 500 and 1500 cars, depending on whether or not the Orange Line is extended along the Needham branch as far as Route 128. For a further discussion of parking impacts at Forest Hills see Appendix J. Generally speaking, the intention is to provide enough parking at Forest Hills Station to accommodate the demand for all-day parking, while closing some or all of the at-grade parking lots and returning on-street parking to short-term use by retail customers.

The following discussion centers upon the extremes of the range of alternatives - the retention and modification of the embankment and the fully depressed alternative. See section 4.3.1.5.4 for a comparison of all alternatives.

Alternative 1   Depressed Rail - No Arterial

Depression of the rail facilities would have substantial benefits within the neighborhoods. The sense of isolation between neighborhoods would be greatly reduced. Passage across the corridor would become psychologically and actually easier and additional crossings and deckings would be relatively easy to construct in the future as conditions change. Landscaping and open-space activities would be visible to both sides of the right-of-way, doubling the visual benefits and making the areas safer because of the added surveillance. Improved noise characteristics and invisibility of trains would benefit adjacent land uses and improve neighborhood quality. However, in the Modified-Depressed alternatives, because of the higher elevation of the depressed-rail facilities, retaining walls and embankment would have to be constructed along certain local streets in the Jamaica Plain area.

The depressed rail facilities would permit a deck enclosure to be built over the tracks at Jackson Square and at McBride/Williams Streets - the site of the new Southwest II high school. This would further reduce acoustic impacts and therefore benefit adjacent land uses. Usable open space would also be increased at these critical locations. At a future date, some additional decking might be introduced elsewhere when changing conditions warrant it. It is conceivable that changing economics may permit building structures over the rail right-of-way in the future. These would most likely occur at or near the transit stations to take advantage of the transit access and the concentration of commercial and community facilities.

Redevelopment of vacant land is much more likely if the rail facilities are depressed because a depressed facility would improve conditions. This redevelopment could influence other property owners and lenders to make repairs and improvements. Negative impacts of uncontrolled vacant land would be eliminated.

Generally improved perceptions of neighborhood quality would favor establishment of labor-intensive enterprises, especially in underutilized buildings now existing in and near the corridor.

Depresssion of the rail facilities and associated primary beneficial effects would induce further neighborhood improvements over time. Long-run progressive neighborhood upgrading could eventually lead to substantial growth of property values and property tax revenues.

Joint development opportunities at stations will provide new and stronger retail services for the surrounding neighborhoods. Impact on existing neighborhood retail should be minimal since many residents currently do much routine shopping outside of the Jamaica Plain neighborhood. It is expected that the new retail facilities will tend to bring this business back rather than reduce existing neighborhood retail business.

Alternative 2 Depressed Rail - Arterial Street East

The arterial will introduce a visual, physical and psychological barrier to cross-corridor movements, especially by pedestrians. At the same time it will reduce traffic on Washington, Amory Lamartine, Forest Hills, Columbus, Call, Chestnut, Centre and South Streets. This will have the effect of reducing visual, physical and psychological barriers. Traffic signals with pedestrian walk lights will be provided at major intersections along the arterial. The overall effect on a person traversing the neighborhood east to west would be moderate easing of conflicts at three to five north-south streets, with a major new conflict introduced by the new arterial.

Vehicle circulation will be eased within neighborhoods by the general reductions of local street traffic. East-west crossings of the arterial will have added difficulty and waiting times at traffic lights. Some trips into or out of the neighborhoods and within the neighborhoods will be facilitated by using part of the arterial. Trips to Orange Line stations will be eased by the added option of the arterial.

The arterial will be relatively unsightly compared to the no arterial option. It will carry some bus and truck traffic since it is intended to remove them from other neighborhood streets. The land area available for landscaping will be reduced by the pavement width.

Traffic on the arterial will generate noise and air pollution which will affect adjacent land uses. At the same time traffic reductions on other neighborhood streets will reduce noise and air pollution in those areas. The arterial street traffic noise will affect new development to the extent that counter-measures such as double glazing or setbacks may be needed, however, development will not be prohibited.

The improved local access provided by the arterial will help to make new development more marketable. Visibility of development parcels will be greatly improved. This approach to them will be more direct and easily explained to persons not familiar with neighborhood street patterns. The arterial will also facilitate movement of service vehicles. Police patrol surveillance of open space and new development parcels will be greater than under the no arterial alternative. Police, fire and ambulance access throughout the Jamaica Plain area will be made easier, safer and more rapid. Delivery vehicles, oil delivery trucks, trash removal trucks, moving vans, etc. all will spend less time on residential streets because of the opportunity to enter and leave the neighborhood on the arterial.

The presence or absence of the arterial should not materially affect the problem of all-day parking by commuters. Parking will not be allowed on the arterial. The arterial will not alter the propensity to drive vs. ride since it is designed as a replacement for existing routes.

Through traffic reductions on Washington Street combined with the removal of the elevated structure should permit its conversion to a very attractive and relatively quiet street accommodating neighborhood retail uses.

The arterial will make truck access to neighborhood businesses somewhat easier. This may forestall some employment losses or create some additional employment.

Alternative 3 Embankment - No Arterial Street

Retention of the embankment plus the added height for bridge clearance and noise barriers would make the visual barrier effect even worse than it is at present. Neighborhood divisions would continue. Wider openings at underpasses and stations would make transverse movements easier and more pleasant. This, however, is not as good as open-air bridges over depressed rail. A drawback of underpasses with an embankment is that the rumble of a train overhead is quite loud and begins with little or no warning for a pedestrian. The problem is not extreme, but adds to the discomfort of neighborhood residents.

Vehicle crossings can be as numerous as with the depressed scheme, however, it is virtually impossible to add a crossing in the future. Pedestrian crossings independent of vehicle crossings are undesirable since they are so shielded from view that they present unacceptable risks to personal security. The only exclusively pedestrian underpass under any alternative would be the Minton Street/Lawndale Terrace passageway. This underpass currently exists and it would be retained and lengthened under alternative three.

The embankments and retaining walls would be cleaned up and landscaped under Alternatives 3 and 4. It cannot be guaranteed that they would always be meticulously clean and well groomed. By nature these are borderline areas between jurisdictions and each party tends to feel that the other is responsible for any defacement, dumping, lack of care, etc.

The noise effects of the embankment alternatives would be more severe than with the depressed alternatives. Noise walls and roadbed improvements would make peak noise somewhat less than at present, but average noise would be as bad as at present or worse because of increased frequency of train movements. As a result, neighboring vacant land would be unattractive for residential redevelopment. Industrial or commercial development might be possible at some points, however land-use incompatibility or lack of arterial street access might preclude even this. Open space uses could be visually attractive, but active use would be unpleasant because of noise and shadowing in morning or afternoon. Security would be a problem because open space would have less surveillance from nearby residents.

Generally speaking, the land use benefits along Washington Street would be realized under this alternative, however, underutilization and decay would remain a problem along the Penn Central alignment. Conditions might even deteriorate further depending on other external factors.

Alternative 4 Embankment - Arterial Street West

This would combine the effects of Alternative 3 with many of the effects of the arterial described under Alternative 2. Visual and transverse movement obstruction would be severe. Vehicular and pedestrian crossings would be added between Atherton and Boylston, at Minton Street, and just north of Forest Hills. This would mitigate the barrier effect somewhat.

The placement of the arterial on the west side of the embankment would reduce the size of several useful land parcels substantially while creating numerous long narrow land parcels on the east side. These would not be very useful and would be hard to maintain. The eastern parcels would be invisible from the arterial and several would have very poor surveillance from residential areas thereby making them unsafe.

The pedestrian underpass between Minton Street and Lawndale Terrace would be superseded by a vehicle and pedestrian underpass at Minton Street. This would reduce the currently existing hazard to personal safety.

Improved vehicular access would not have the same land use benefits described under Alternative 2 because the environmental problems of the embankment and the reduced parcel sizes would tend to discourage development in spite of access benefits.

On balance, this alternative is likely to continue stagnation of land usage and is unlikely to stimulate the neighborhood upgrading and new development possible with Alternatives 1 and 2.

5.6.7 Local and Neighborhood Project Impacts - Land Acquisitions

In addition to land originally acquired and cleared for I-95 South in the Southwest Corridor, additional parcels, depending on the alternative, are required for proposed construction in this project (see Fig. V-38). However, not all the land originally acquired and cleared would be needed for the construction. The proposed land use for the residual parcels already acquired or to be acquired is covered in Section 7.4.

As shown in Fig. V-38, the Modified-Depressed Alternative, FH-5 (combining with Alternative SC-1) and Post Hearing Profile PHP-2 would have the most acquisitions. They include 16 full commercial takings and 18 residential takings which would have to be relocated (partial takings listed need not be relocated).

Of the 16 full commercial takings, three are in used-car sales, auto parts or wrecking (junk yard) businesses. The American Legion Post #76 located on the Arborway and the Garmet Lounge on Columbus Avenue in Back Bay would involve transfer of liquor licences.

Three full residential takings in the Back Bay area consist of a multi-family apartment building and two row-houses. The latter would involve demolition of sections of adjoining row-houses. The end walls exposed after demolition would be strengthened and the residual area properly landscaped.

On the other hand, the combination of SC-2 and FH-3 would have the least amount of takings - three full commercials and one full residential.

The number of takings has been minimized by the choice of alignments which closely adhere to the former Interstate 95 right-of-way (which was largely cleared of structures), except in the South End where the expressway was not to have been built. In the South End the alignment follows the existing Penn Central Shore Line right-of-way, though the alignment exceeds the current right-of-way width. Details of relocation and land requirements are shown in Appendix K.

In the execution of the analysis, several detailed alignments were studied. Through the South End an alignment was chosen that requires the taking of residential and commercial property. These are also documented in the Section 106 statement on Historic District impacts in Appendix A. Other alignments studied for the South End take as many as 35 structures, or as few as 4. The latter alternative would involve a full Orange Line tunnel under the rail alignment at considerable cost and lesser overall noise attenuation benefit than the chosen preferred alternative (see section 4.4.2). This tunnel would leave the existing railroad right-of-way without significant noise attenuation measures, i.e., it would not be covered. The alignment and noise attenuation measures chosen for the South End/St. Botolph area is the result of the consensus of the South End/St. Botolph Task Force. This Task Force was composed of citizen volunteers, agency personnel, and members of the Southwest Coordinator's staff. It's report is part of the Public Hearing Testimony.

At the Hearing, several speakers made reference to a four-foot taking line in the South End area. This line would be to the east of the existing railroad right-of-way between Yarmouth Street and Massachusetts Avenue and located in the bed of existing Claremont and Carleton Streets which parallel the right-of-way. The deed for the new Titus Sparrow Park excludes this four-foot area, since it

was anticipated prior to conveyance to the City Park Department. MBTA expects that this line will not be exceeded in any new permanent construction in that area except at the intersection of Massachusetts Avenue where two large brick structures abut the right-of-way. Construction easements beyond the four-foot line will be required. During engineering phases, the brick structures mentioned above will be examined to determine their suitability for underpinning. If they cannot be underpinned they would be demolished.

Refinement to the profile between Ruggles Street in Roxbury and Morton Street in Jamaica Plain may permit a reduction in takings or eliminate the demolition of certain structures. This will be explored and detailed in the engineering phases of the project.

As a result of changes made in the project on the basis of comments made at the Public Hearing and the work of the Task Force on Vertical Profile, three additional properties are affected by the proposed project as described by the Post Hearing Profile. These properties are located on New Heath Street where the street bridge shown in the fully depressed alternative but revised to a pedestrian overpass in the modified alternative, was restored in the "Post Hearing Profile" so that it will carry vehicular traffic. This bridge crossing requires the raising of New Heath Street from the existing "sag" which it currently follows in profile to a more nearly flat profile and the raising of the grade of the end of Terrace Street to meet the proposed New Heath Street grade. The raising of this street affects access to three commercial properties as follows:

38 New Heath Street (J. Fleishman)

41 New Heath Street (former Croft Brewery)

166 Terrace Street (Argosy Printing)

All three of these are commercial properties. Raising the street and sidewalk would require closing basement windows of the buildings at 41 New Heath and 166 Terrace, would require revising the entries to 166 Terrace and would require revising the access to the property at 38 New Heath Street.

5.6.8 Local and Neighborhood Project Impacts - Modified Depressed and Post Hearing Alternatives

Development Potential

The development of land cleared for Interstate 95 is an essential element of the Southwest Corridor Plan. Planning during the last 36 months has described uses for each parcel in the Corridor. Those between Ruggles Street and Forest Hills are included for each alternative shown. Differences in land area and general feasibility for each site under each alternative, including the "build" and "no build" Segment #3 Arterial is documented in Section 7.4.3.

Noise Levels

Analysis of the "modified depressed" alternative reveals that noise levels slightly higher than those in the "fully depressed" alternative would occur on certain development parcels. These levels, however, generally fall below the 67 dbA noise level determined as acceptable for development (this is the equivalent level determined by the Federal Department of Housing and Urban Development for publicly assisted housing funds, see page H-5 of Appendix H).

In Jamaica Plain, certain parcels have areas that will experience noise levels above 67 dbA. Even in the fully depressed alternatives, these areas fall in a zone approximately 100 feet from the edge of the rail right-of-way. In this lower density neighborhood, any development that has a noise sensitive nature would have to have a setback in order to meet the 67 dbA criteria. The

City of Boston Zoning Code typically requires rear yard setbacks of 40 feet in such residential areas. The "Post Hearing Profile" reduces noise levels to a point which is quite similar to the fully depressed alignment (Figs. IV-49 to IV-65). This means that the location of habitable space in proposed projects which would include yard setbacks would be affected adversely by noise in a zone between 40 and 100 feet from the rail or arterial facility.

This zone of impact often falls within the proposed "Greenbelt" that has been provided to serve this buffering function (see plan illustrations), so that development of these sites is not affected adversely. In cases where the 67 dbA level is exceeded, the impact is associated with both the "fully" depressed alternative as well as in the "Post Hearing Profile".

In Roxbury, higher density residential development is contemplated on several parcels. In most cases, noise levels on these parcels will be established by the presence of the proposed Arterial Street or existing Columbus Avenue. This is true of residential uses on parcels 18 and 34. Potential residential use on parcels 24, 26, 28, 30, 32 is viewed only as an alternative to the proposed Roxbury Community College and will be governed by the noise of the Arterial. That proposed on Terrace Street, parcels 25, 27a and 27b is of long term potential based upon the turnover of existing topography so that noise level differentials between the fully depressed and modified depressed alternatives were not significant for these parcels.

Proposed parklands and industrial zones would likewise not be adversely affected by the projected noise levels even at their maximum degree in the projected year 2000. The proposed greenbelt is intended to provide a buffer zone against these noise levels. The development of industrial areas is not affected by noise levels. Institutional development that might be located in the Corridor could be constructed without setbacks, against the transportation facilities, but would have to contain noise attenuation devices such as double glazing and air conditioning for particularly sensitive activities.

Site Preparation

Development is also a function of site preparation costs as they affect a given proposal. Site preparation on urban sites consists usually of the excavation of any remaining foundation material or fill left from previous construction, and utility hook-ups and sidewalk replacement. In addition, soil conditions owing to substrata and water table levels have a significant impact upon cost in the areas of the Stony Brook Valley.

Filling of sites as contemplated in the "modified depressed" alternative and to a lesser exeent in the "Post Hearing Profile" (the preferred alternative) must be accomplished in one of three ways in order to avoid the addition of cost to the proposed development.

The first alternative would be used where single, two, or three story construction is contemplated. In these instances excessively compressible material currently in place, if any, would have to be removed and replaced with engineered fill capable of supporting structures of the type contemplated.

A second alternative involves the placement of engineered fill capable only of sustaining floor slabs or paved parking areas. Foundations would then be placed so that they penetrate the fill and the excessively compressive soil (if any), and these would support structures of more than four stories.

A third alternative involves no filling of a permanent nature, but rather the placement of permanent retaining walls as the proposed building line adjacent to either the arterial street or the proposed railroad/transit facility. The development site would then be graded with temporary fill that would be excavated upon permanent building construction. Such excavated areas would then become basement areas in the permanent construction.

Roxbury Community College offered specific testimony at the Public Hearing which enumerated certain performance criteria of the "Depressed" and "Modified Depressed" alternative. These criteria are as follows:

1. The boundary of the proposed Arterial between Roxbury and Heath Streets must not extend further east than the existing line of Columbus Avenue.

2. Land fill and/or alignment requirements of the proposed Arterial must not reduce the buildable area of the RCC site such as to force extensive community owned or owner occupied property takings for college use. If excess construction costs, such as extended foundations and retaining walls are required to achieve the existing buildable area without takings, such cost must be borne by the Arterial construction.

3. Vehicular access to parking, student drop-off, and college services from the Columbus Avenue (west) must be maintained at all times during the Arterial and rail construction. In addition, the construction process should not hamper the normal flow of vehicular and pedestrian movement to and from the college during operating hours.

Requirements #2 and #3 will be met in the engineering design of the Southwest Corridor Project as it abuts the college site between Roxbury Crossing and Jackson Square. The MBTA and the Massachusetts Department of Public Works will work closely with the college project's designers to assure that these goals are met, and to minimize the impact associated with any intrusion of the alignment to the east of existing Columbus Avenue.

Visual Appearance and Slope Configuration

The Modified Depressed Alternative will have the same neighborhood impacts as the Fully Depressed Alternatives except for the following:

- The trains will not be as deeply depressed. This will increase noise impacts somewhat. Catenary wires will be at or above eye level instead of below it, and trains will be visible. Air rights construction and future added crossings will be much more difficult to accomplish.

- The cross streets will have to be raised to clear the rail/transit alignment. This will cause the cross streets to hump up, resulting in some visual discontinuity as one looks along the street.

- The arterial street, if constructed in Jamaica Plain, will have to be raised to meet the cross streets. This will create a visual barrier along the right-of-way. Much of the open space strip along the arterial will have to slope down to the existing grade.

- Several additional full or partial takings will be needed in order to accommodate the new street profiles. In addition, a number of properties will have to be physically altered to meet the new street profiles, even though they will not have to be taken.

The Post Hearing Alternatives approximate the visual and slope characteristics of the Fully Depressed Alternatives at several locations. At others, they approximate those of the Modified Depressed Alternatives. See sections 4.3.1.5.4, 5.5.2, 5.5.3 and 7.4.3 for a description of these comparisons.

5.7 Other Impacts

5.7.1 Visual and Functional Impacts

In its present configuration, the Penn Central Rail Corridor constitutes a sizeable barrier to community continuity. Passing through the South End and St. Botolph areas, the Rail Corridor is slightly below grade; through Lower Roxbury, the tracks begin their rise to the 20 ft. high embanked elevation at which they pass through Roxbury and Jamaica Plain.

The existing Rail Corridor constrains access between a series of residential communities along its length by severely limiting passage between them. Various pedestrian tunnels (in Roxbury and Jamaica Plain) and bridges (in the South End and St. Botolph areas) provide access between divided neighborhoods, but in the context of urban life, these often represent dangerous situations that invite crime. In the segments where the tracks are raised on an embankment, communities are further denied visual access from one side to the other. This situation further encourages crime and contributes to the decline of residential neighborhoods by creating unobserved and unusable areas.

In the modified embankment option, the existing track bed would be raised several feet and the entire embankment widened. The additional width, as well as the increased vertical dimension (due to sound attenuation devices and overhead power supply systems) will extend the existing shadow pattern over land adjacent to the embankment, detracting somewhat from the desirability of these parcels as potential development sites. In a depressed option, shadows obviously would not be an issue and in fact the removal of the embankment brings sunlight to numerous parcels which for years have been negatively impacted by the shadow of the current embankment.

The character of the residential neighborhoods which abut the existing embankment varies from occasional high density housing (Bromley Heath, Mission Hill) to single and multi-family residences, the predominant housing type. The present rail corridor and embankment is an unavoidable intrusion to the intimate scale and desirable character of these residential districts.

In the depressed options, the great bulk which the embankment represents is not a factor; still the discontinuity that a large open depression presents must be addressed in the design of the facility.

Removal of the barrier effect of the embankment would join neighborhoods which have essentially the same ethnic and economic characteristics across the tracks. The two portions of Roxbury would join each other; likewise the two portions of Jamaica Plain would be connected. This impact is seen as entirely beneficial.

In Roxbury, the isolation of the Mission Hill and Bromley Heath Housing would be largely eliminated. Its residents would have access to the facilities to be located in the Southwest Corridor and particularly would be in close proximity to the open space facilities provided adjacent to the transportation elements.

Views of Roxbury Highlands from Mission Hill and vice versa would be possible. Access to the underutilized Connolly Playground, for example, would be opened to Bromley Heath residents who have inadequate open space - they would also be provided with open space at an expanded Albert Street playground over the depressed rail alternatives.

In Jamaica Plain connectives between schools and playgrounds would be afforded residents now cut off from them. This is particularly vital for those who live in the smaller portion of Jamaica Plain between the railroad and Washington Street. The small size of this neighborhood has tradtionally handicapped it without adequate facilities and city services.

The corridor presently exhibits considerable topographical diversity. While the Stony Brook originally flowed through the basin area along the Penn Central alignment, there are places where hills have been cut or areas filled in order to establish the topography which is seen today. This filling and cutting was largely the result of creation of the railroad embankment and the provisions made for maintaining cross streets.

The proposed post hearing profile and alignment for the transit project will require additional revisions to the landscape in order to meet the goals of providing the benefits of full depression, neighborhood continuity, and linkages across the tracks. Changes in street grades (which will be held to a maximum of 5% gradient) will in part determine the nature of the slopes of adjacent ground. These will, in general, be gentle and fully landscaped. In all cases, streets and sidewalks will be constructed to avoid the flow of any surface water run-off onto adjacent property.

The proposed "Post Hearing Profile" has been carefully drawn so that the adjacent ground levels encourage both the creation of useful open space, improved access to transit stations, and future development. It is intended that this development be permitted and encouraged to occupy vacant land right up to the edge of the railroad/transit depression (except at locations where the "green belt" buffer is planned, or where rear yard zoning setbacks are dictated) and permit its bridging by air-rights construction as required.

At the Southwest Corridor Public Hearing, several participants expressed the feeling that the design of the relocated Orange Line and Arterial Street should provide the setting by which communities presently visually and functionally separated can once again become one.

Barriers to neighborhood coherence may be either physical or psychological. Physical and psychological barriers are currently present in the form of the existing 15-20 foot high railroad embankment. This structure can be penetrated and crossed only at discrete points, the perpendicular streets which occur as major traffic ways. In Jamaica Plain only two additional pedestrian crossings exist (one at Lawndale Terrace and the other at Morton Street). While the removal of the embankment will make crossings theoretically possible at any location, the practical necessity of bridging the railroad/transit "cut" will limit this theoretically infinite ability. Furthermore, unlimited public pedestrian access across the rail facilities would make unclear the distinction between public and private domains which is necessary to maintain security.

Perhaps the most important impact of embankment removal is the psychological effect. This effect can be characterized as primarily resulting from visual connections from one side of the tracks to the other, and from removal of the blank granite walls which support the current railroad alignment. The removal of the embankment and reconstruction of the right-of-way in the new "Post Hearing Profile" will be accomplished in such a way as to permit visual continuity. This continuity is most important at streets which cross the right-of-way, since it is there that pedestrian and auto movement will be concentrated.

Further, future air-rights construction or building construction adjacent to the right-of-way will block such visual access between cross streets as it would in a typical city block. For these reasons, visual connections are most important at cross streets, and these "visual corridors" must be kept open through careful determination of the project's vertical profile which should be constructed to allow maximum visual access consistant with the limits of the natural topography. The "Post Hearing Profile" of the proposed transit/railroad facility and the arterial street has been drawn with this objective in mind, and is the preferred alternative of the MBTA.

Functional linkages from east to west across the rail/transit/arterial right-of-way are of several types. Auto, bus and pedestrian access from the different sectors of each neighborhood should be maintained or improved in such a way as to:

1. encourage the connections from the Stony Brook and Washington Street neighborhoods to Jamaica Plain areas to the west of the railroad.

2. encourage the use of Roxbury Crossing and Jackson Square as meeting places for commerce and work in Roxbury.

3. allow the easy movement of children, the handicapped, and the elderly to schools, churches, and places of business in the neighborhoods as a whole.

These linkages will be facilitated in the "Post Hearing Profile" which has been drawn within the following criteria:

a) No new street gradient, parallel or perpendicular to the tracks will exceed 5%. This rise, approximately 5 feet per 100 feet of horizontal run is easily traversed in all weather conditions. In addition, existing downgrades currently as steep as 12% will be eased to facilitate this linkage.

New street gradients over the rail right-of-way are approximately as follows:

	Existing Grade		"Post-Hearing Profile" Proposed Grade	
	East	West	East	West
Ruggles Street	Level (4' sag)	Level	+1%	+2.5%
Prentiss Street	-2%	Level	+2%	+5%
Tremont Street	Level to -3%	-3 to -5%	Level	Level
Cedar Street	-12%	n.a.	-5%	Level
New Heath Street	-9%	-3%	-5%	+3%
Heath Street	-5%	-2%	+2%	+3%
Centre Street	Level	-5%	+2%	+2% (2' sag)
Atherton/Mozart Street	-6%	-7%	Level	+2% (4' sag)
Boylston Street	-2%	-2%	+4%	+3% (6' sag)
Minton St/Lorene Rd	n.a.	n.a.	+4%	+1%
Green Street	Level	-3%	+3%	+1%
Gordon Street	n.a.	-6%	n.a.	-4%
Williams Street	Level	-5%	+5%	+2% (3' sag)
McBride Street	Level	+1%	+5%	+2.5%
Morton Street	Level	-5%	+4%	+1%

b) Cross street at new transit stations will be reconstructed as necessary to achieve the above listed gradients, and in addition, will be designed to facilitate pedestrian movement across the rail facility and to new stations. Such reconstruction will consist of new paving of travel lanes (to existing street widths), pedestrian sidewalks and paths and new street landscaping

(trees, signs, benches and lighting). Such designs will preserve and enhance pedestrian scale and personal safety. At the Bromley Heath and Mission Hill housing developments, where grade adjustments will entail the filling of certain areas, new or replacement pedestrian walkways will be constructed to facilitate pedestrian movement, security and patronage at new stations. These access ways will be based upon expected predominant pedestrian movements and will be made secure through appropriate fencing and lighting.

c) Acoustic decks to be provided at the Mission Hill and Bromley Heath housing developments will be located at elevations which place them at, or immediately above, the ground elevations within the housing areas. In no case will such deck levels be located above window sills in the first floor dwelling units nearest the deck areas. In this way, line of sight observation of activities on such decks will be possible and will provide for surveillance of areas by residents from within their dwellings. The activities on these decks will serve as additional meeting places that are visually and physically accessable to residents living on both sides of the Corridor. Grades at the building lines in these housing developments will be held from 6 to 8 feet or more below window sills to promote the security for residents.

d) Connections from the proposed "green belt" would be to such deck areas and would be signalled by coordinated landscaping and lighting in order to further enhance the linking aspect of the Corridor's function. (This linkage concept is illustrated in Fig. A-14 of Appendix A in the E.I.S., which shows landscaped links to existing streets, parks, and institutions from the Corridor.)

The arterial street in Jamaica Plain, if it should be built, is of critical concern in the contemplation of such tranverse linkages across the rail facility. The design of the arterial is of paramount importance in the perception of such visual linkages. First, any arterial must be perceived as "approachable". That is, pedestrians must view it as consistent in size and scale as other local streets. It must be carefully landscaped so that it does not become a "clear cut" zone in which no plant material will be permitted to grow. Pavement widths for vehicular travel should be kept to a minimum, with no continuous shoulders permitted to widen the paved area. Sidewalks should contain premium pedestrian treatments, with benches, signs, and tree planting carefully detailed. No "Free Right Turn" channelization of vehicular traffic should occur as this increases traffic speed and flow and inhibits pedestrian approachability.

Signal phasing and pedestrian activated crossing signals should be designed to allow maximum "green time" for cross Corridor pedestrian and vehicular movements so that intra-neighborhood linkages are enhanced.

The single greatest obstacle to adequate cross-town linkages is the traffic colume itself. Volumes projected at Arterial Segment #3 are of significant magnitude. The virtue of any such arterial must lie in its ability to divert traffic from adjacent parallel streets and to improve cross corridor connections across those streets. The reduction in such traffic volumes (Centre Street from 12,500 to 10,000; Lamartine Street from 10,000 to 1,000; Amory Street from 21,000 to 13,000. All figures are year 2000, 24 hour A.D.T. volumes) essentially represents a shift in such barriers from a series of local commercial or residential streets to the Corridor, where traffic would parallel the transit/railroad facility and be buffered by virtue of the proposed Green Belt and planting areas which run alongside the facilities. The concentration of such traffic in one rather than in 3 or 4 streets is the basic premise of the arterial. In order to be successful, and not just an additional obstacle to neighborhood cohesion, its design must be carefully balanced with traffic management techniques which should be used on other streets. For example, measures to diffuse and divert traffic from Lamartine and Amory Streets would include selective dead-ending and contra-flow one way routings. Furthermore, any arterial should not be designed to such standards so as to significantly increase total traffic volume across a corridor area out through Jamaica Plain.

The Capital Grant Application states that the entire Relocated Orange Line will have provisions for the handicapped (see Project Description, Exhibit M). In addition, the commuter rail facilities provided will have such facilities as specified as part of the Southwest Corridor project. All street revisions and Arterial Street construction will include wheelchair ramps.

It is proposed that existing street gradients be reduced in many locations to permit easier access, particularly in winter conditions. Access from the Bromley Heath public housing project along Centre Street to the proposed Jackson Square transit station would be much improved by new street grades, new access ways and lighting. Access to certain housing structures within the project for the handicapped is possible if such structures were converted to handicapped use (none are in such condition at present).

5.7.2 Safety Impacts

The proposed modifications to the existing street patterns for both the "build arterial street" and "no-build arterial street" option have been discussed and approved in a preliminary stage by representatives of the Public Improvements Commission and other agencies of the City of Boston. Included in this review, for purposes of considering public safety and emergency vehicle access, has been the City's Fire Department. The street patterns have also been discussed with residents at numerous community meetings. In addition to providing for all primary north-south emergency vehicles patterns, two new east-west street crossings have been added: at Minton Street/Lorene Road, which will increase flexibility for access to a large section of Jamaica Plain, and at Cedar Street, which will allow direct access from the new arterial to an industrial area of Roxbury.

The work of the Task Force on Vertical Profile since the Public Hearing has re-inserted two street bridges in the proposed project, New Heath Street and Prentiss Street. These will also serve to increase access flexibility in case of an emergency.

The existing low clearance underpasses under the existing embankment present hazards and restrict movement of the largest of current fire-fighting equipment of the City. The depressed profile will eliminate these constrictions to vertical clearance.

The Capital Grant Application includes a complete fencing of the rail/transit right-of-way (in those areas not covered by decking) in order to prevent accidental or unintentional access onto the right-of-way. This fencing would also help, to the extent possible, to prevent the malicious destruction of railroad and transit property. The application notes that particular attention will be paid to the design of this fencing in historic districts and station areas. Special attention will also be given to fencing in locations adjacent to schools and playgrounds. The project will provide a major improvement over the existing largely unfenced railroad embankment.

Personal safety will be addressed through pedestrian-oriented sidewalk and intersection design, through careful use of lighting of the streets and sidewalks, the station, and the access ways. The station attendant's booth will be located so as to provide maximum visual surveillance of both the platform and lobby, including any pedestrian overpasses or underpasses.

The arterial street traffic poses safety questions similar to those of Functional Linkages. The street would create an increase in traffic in specific locations in return for a decrease in traffic in other locations. The relative amount of safety to pedestrians in one scheme versus the other is a matter of subjective opinion.

5.8 Replacement Service

While the elevated structure on Washington Street is to be removed as part of this project, it is the intention of the Commonwealth and the MBTA to replace this facility with an appropriate transit service. A committment by the Secretary of Transportation to the provision of a replacement service is included in Appendix G.

While most of the population data in this analysis is not sufficiently fine grained to illustrate the character of any immediate area along the elevated, the population affected by this change in service is represented by the population characteristics of the Corridor as a whole as described in Section 2.2.

The map of Population Density, Figure II-10b, illustrates that the heaviest accumulation of residents in the Corridor is along the Penn Central rail corridor and not along Washington Street. Noise levels caused by the Elevated are documented in Section 2.3.2.2 and Site #7 of Appendix H. The operating characteristics and service area of the existing El are documented in Section 3.2.

Speakers at the Southwest Corridor Public Hearing who represented local South End or Roxbury users of the Orange Line spoke in favor of the Relocation of the Orange Line. They favor surface transit (often light rail) and not a subway or Orange Line solution for Washington Street between downtown Boston and Dudley Station.

An examination of options for replacement service will result in an E.I.S. for that service and perhaps the extension of that as a new service to Dorchester and/or Mattapan. The MBTA Board of Directors has approved the execution of this E.I.S., as well as its consultant contracts. Contract negotiations with the consultants are now nearing completion; a notice to Proceed with this E.I.S. is expected in a few weeks, subject to UMTA approval.

Several suburban representatives at the Hearing have suggested that a subway under Washington Street be studied. The Southwest Corridor E.I.S. documents that such a study has already been performed. The consequences construction methods , patronage, costs and benefits of such a subway are included in this E.I.S. The Southwest Corridor Working Committee, which includes city and suburban representatives, at its meeting of 23 February 1976, discussed this documentation and unanimously rejected such a proposal as inconsistant with the needs of local residents and businessmen. Minutes of this meeting are available.

Two primary possibilities for a replacement service are a reserved right of-way light rail line and a reserved lane bus line. A light rail line would run along Washington Street from Dudley station to Broadway, on Broadway to Tremont, then into the Green Line subway through the abandoned trolley tunnel from Broadway to Boylston station, terminating at Park Street station. The reserved lane bus option route would run along Washington Street from Dudley Street to downtown and would terminate in the vicinity of State Street or Haymarket Square. By operating through the subway the light rail line time from any point to Park Street station would be about 0.7 minutes less than the busway time to Summer Street. However, the bus route would be more convenient for destinations on Washington Street in the downtown area.

The light rail line running time to Park Street would exceed Orange Line time to Washington Street by 4.8 minutes at Dudley, 3.2 minutes at Northampton and 0.9 minutes at Dover. However, the light rail line would have several additional stops. North of Massachusetts Avenue, the light rail or bus line would have stops in the vicinity of W. Concord Street, W. Brookline Street, Waltham Street, E. Berkeley Street, Broadway and the subway portal.
This would reduce access time for riders now using Northampton and Dover stations by up to 5.8 minutes. Consequently, if the replacement service were operated on the same headway as the existing Orange Line, travel times to downtown Boston would improve compared to existing service for 14 of the 20 zones that would otherwise have increases with the relocation. For the other six zones light rail

replacement service would result in greater travel time than existing service.

A busway as replacement service would reduce downtown travel times compared with existing service for 12 of the 14 zones experiencing reductions with the light rail service. Transfer times would be greater from busway to other rapid transit lines than for a trolley.

The annual user benefit of light rail replacement service would be approximately $100,000 per year compared to the "no build" option, considering only benefits to users of the existing Orange Line from zones north of Massachusetts Avenue. Compared to the relocated alternative without replacement service the light rail replacement would have user benefits of $386,000 per year, again considering only benefits to users of the existing Orange Line for north of Massachusetts Avenue. The estimated operating cost for a light rail replacement from Dudley to North Station would be $1.6 million per year. A reserved bus lane replacement would have annual user benefits of $45,000 per year compared to "no build" and $331,000 per year compared to relocation without replacement service. The annual operating cost for a bus service from Dudley to Haymarket Square would be $0.9 million per year.

South of Massachusetts Avenue the access time savings of a replacement service compared to the "no build" options would not be sufficient to offset the extra run time. The replacement service would, however, result in faster times to downtown from zones 109 and 112 than would the relocated service. The two zones contribute about 430 one-way daily riders to the existing Orange Line. The annual user benefit to these riders of a South End replacement service compared to a Relocated Orange Line alone would be $33,000 per year with the light rail option or $15,000 per year with the bus option.

Approximately 4,000 present Orange Line riders would use new surface transportation on Washington Street if it were provided.

In addition to these riders, the replacement service would attract some new ridership and would divert some riders from other transit lines such as the Tremont Street bus. A direct demand analysis for replacement service results in an estimate of 7,000 daily riders. By way of comparison, in 1960, the last full year that streetcar service was operated from Lenox Street (near Northampton) to North Station via Tremont Street and the subway, there were 6,300 one-way daily riders. There have, of course, been significant population changes since that time.

Such an at grade facility through the South End would attract all of the walk-in riders in the Dudley Square area with downtown destinations, with service quality at least partially "replaced". What remains, however, in terms of geographic areas still experiencing disbenefit is the entire feeder area to the south and east of Dudley Square, particularly zone 107, which is bounded by Blue Hill Avenue and the Midlands Division right-of-way. To examine alternative methods of improving transit service to these areas, the Authority is undertaking a major "South End Replacement, Roxbury Replacement/Dorchester, Mattapan Transit Improvements Study". At the conslusion of this study, specific proposals will be made for these areas. Because the data describing the user benefit of the relocated alignment assumes no such service, it represents the most conservative description of ultimate service conditions.

<u>Interim Service</u> until installation of a permanent replacement would be determined by the nature of the new construction process required by the proposed facility. The minimum permanent service proposed as replacement for the existing

elevated would establish a headway as shown in the following table for the assumed demand levels indicated:

MINIMUM LEVEL OF SERVICE

in Replacement of Orange Line El
between Dudley and Downtown
Boston

Headway (in minutes)

Mode	Passenger Demand			
	4,000 Daily		7,000 Daily	
	Peak Period	Midday & Early Evening	Peak Period	Midday & Early Evening
Standard Bus (Permanent or Interim)	3	10	2	8
LRV	6	12	4	10
PCC	4	12	3	10

NOTE: The above headways were determined by using MBTA Load Standards to calculate approximate frequencies which were then tempered by scheduling considerations. Upon the completion of the Environmental Impact Statement for the Replacement Service a full circulation of the documents will be made. A commitment to the Replacement Service has been expressed by the Massachusetts Secretary of Transportation (see Appendix G).

5.8.1 Removal of the Elevated

Removal of the existing Elevated structure between South Cove and Forest Hills consists of the dismantling of 4.2 miles of steel structure with rail and wood ties, and of five intermediate stations. The terminal station at Forest Hills will be removed and temporarily replaced as an initial part of the work because of its interference with construction in that area. Portions of the intermediate station facades may be incorporated into the design of proposed new Orange Line stations and may be removed under a separate contract.

The removal of the elevated has recent local precedent on the Orange Line Project north of downtown Boston between North Station and Everett. The most congested and built-up section of this work was along Main Street in Charlestown. This 2.7 mile section of steel structure and stations was removed in 7 months with a very minimum of disturbance and disruption. In fact, much of the work which had been planned with the Boston Traffic and Parking Department to occur at night in order to minimize traffic disruption was allowed to take place during the day, as the minimal disruption that would occur was considered less a problem than the desire to proceed quickly with the work.

Using the Charlestown experience as a guide, the demolition of the southern Orange Line Elevated is projected as follows. The Authority would retain ownership of certain items, particularly certain signal devices and electrical equipment and steel rail. The remaining material would become the property of the contractor. Ties would be resold and steel from the structure would be sold for salvage. (In Charlestown, the Contractor was unable to find someone interested in immediate re-use of the steel which was stored until sold as scrap.) There would be only a small amount of unsalvagable material, such as splintered wood from the station wall and platforms.

Cable and signal equipment would be removed from the structure first. Steel girders, beams and bents would then be cut into sections with acetylene torches and then loaded on flat-bed trucks to be transported to a staging area (Probably a location in the cleared land in the Corridor). All dismantling of ties and other equipment from the structure would take place at the staging area allowing dust to be controlled and allowing this work to proceed without impact upon traffic or the Washington Street area neighborhoods. As beams and bents were to be removed, traffic would be re-routed in segments a block or two in length at a time, and for no more than two or three days duration in any one location. In critical areas, as determined in consultation with the City of Boston Traffic Commissioner, removal would be carried out at night to avoid traffic disruption. Noise associated with this portion of the work would be that of acetylene torches and of hoisting cranes when lifting. Nighttime operations would require floodlights and portable power generators. Areas with traffic problems such as Dudley Station are areas with few residential units and thus operation at night would not have adverse impact. The contractor would be responsible for continuous sweeping of the street in areas where the structure was being removed.

Stations would be dismantled in their current location as the removal of the structure proceeds. Following the removal of the structure, remaining sections of the steel columns would be removed to three feet below the ground surface and street and sidewalk repair would proceed. Air compressors and equipment would be required for this portion of the work, but this work would be accomplished during the day and would only be in any given location for a day or two.

In summary, the removal of the overhead structure would be accomplished in 12 months within a total contract time of 18 months. Traffic disruption and noise impacts would be strictly of a local nature and of short duration--only a few days at any one location. Most materials would be re-used or salvaged. The small amount of air pollution produced would be from the construction equipment used. There would be little or no grease or oil on the steel structure at locations where it is to be cut by torch. The only dust produced would be in the dismantling of the stations and in the staging area associated with tie removal. No water pollution is expected from the project. The experience in Charlestown indicates this project can be carried out successfully with very little adverse impact.

5.9 Cost Versus Environmental Benefits

A comparison of benefits between the various railroad/transit alternatives can be made on the basis of the following criteria:

1. Noise levels at critical locations

2. Street gradient at typical intersections

3. Extent of fill above existing grades at selected locations

4. Number of takings, and

5. Potential development

The incremental cost between alternatives can thus be compared to changes in these five parameters in order to evaluate the cost of additional benefits provided by each alternative.

It should be emphasized that the project has many variables and is extremely complex and that any such simplification of cost level of benefits must gloss over many important considerations.

Absolute Values

The table on the following page shows the construction cost, noise level, street gradient, height of fill, number of takings, and potential for development for the Embanked, Modified Depressed, Post Hearing and Depressed alternatives, with no arterial street.

The "no build arterial" alternatives were selected for comparison in order to isolate the benefits of the railroad/transit facility since it is the major proposed investment.

The construction costs are given in 1976 dollars.

Levels, given in dbA, for receptors at the following locations:

Location	#1	S.W. II High School	50' E from Tracks
	#2	Boylston Congregationa- Church	150' E from Tracks
	#3	Amory Street Apartments	150' E from Tracks
	#4	Mission Hill Housing	50' W from Tracks
	#5	Bromley Heath Community Center	50' W from Tracks
	#6	Roxbury Community College Site	100' E from Tracks

Gradients are given for streets over the rail right-of-way at the following locations:

Location	#1	Ruggles Street
	#2	Tremont Street
	#3	New Heath Street
	#4	Centre Street
	#5	Atherton/Mozart Street
	#6	Green Street
	#7	Williams Street
	#8	McBride Street

For the Embankment Alternative, the existing gradients are shown in the table.

CRITERIA		Embanked		Modified		Post-Hearing		Depressed	
		ALTERNATIVE							
CONSTRUCTION COST (1976 $ Million)		167.0		242.3		286.2		362.9	
NOISE LEVEL - dbA	Location #1	>72		<72		<72		<72	
	#2	<67		<62		<62		<62	
	#3	<72		<67		<62		<62	
	#4	72		62		62		62	
	#5	<72		<62		<62		<62	
	#6	<72		<72		62		62	
	Average	<71		<66		<63		<63	
STREET GRADIENT - %		East	West	East	West	East	West	East	West
	Location #1	level	level	+2	+4	+1	+2.5	+1	+3
	#2	level to -3	-3 to -5	+4	+4	level	level	level	-2
	#3	-9	-3	not possible		-5	+3	-8	+1
	#4	level	-5	+5	+5	+2	+2	+1	level
	#5	-6	-7	+2	+3	level	+2	+5	+5
	#5	level	-3	+5	+3	+3	level	+4	-3
	#7	level	-5	+5	+5	+5	+2	+3	+4
	#8	level	-5	+5	+5	+5	+2.5	+1	+1
HEIGHT OF FILL - feet	Location #1	27		11		2 (6' to deck)		0	
	#2	21		4		0		0	
	#3	19		4		4		0	
	#4	14 (22' to top of canopy)		4 (to deck)		0 (to deck)		0 (to deck)	
	#5	25		7		3		0	
	#6	21		10 (to deck)		3 (to deck)		3 (to deck)	
TAKINGS	Residential	10		19		18		11	
	Commercial	6		20		13		7	
	Total	16		39		31		18	
DEVELOPMENT (acres)		0		13.1		22.5		27.3	

The "height of fill" is defined as the final ground elevation of "blade wall" immediately adjacent to the rail/transit facility, compared to that of an observer at the following locations:

Location	#1	End of Child Street	Elevation 33'
	#2	At Johnson Playground	Elevation 37'
	#3	End of Chestnut Terrace	Elevation 35'
	#4	At Bronley Heath Comm. Center	Elevation 39'
	#5	At Station Street	Elevation 21
	#6	At Mission Hill (300' north of Prentiss Street)	Elevation 19'

For the Embankment alternative the "height of fill" assumes 6-foot noise walls (the catenary would rise an additional 12 feet above the noise walls). For the Modified alternative, the height is estimated to be that necessary to fully obscure catenary (minimum 19 feet above tracks).

The development criteria is defined in terms of "potential for development".

A measure of the short- and long-range development benefit associated with the rail/transit facility options is gained by a comparison of the ability to easily use potential air-rights space available over the tracks. For comparison purposes, this has been defined as a deck over the tracks whose elevation is no higher than six feet above the elevation of an adjacent street or existing ground.

The area counted does not include any potential air-rights deck accessible only from the possible arterial street Segment #3 nor any station areas or cross streets. It does include deck area presently included in the project as recreational and open space decks for noise reduction and community connecting. This is, in fact, viewed as one of the most important of air-rights development uses. There is no potential for air-rights development assigned by this criteria to space over the modified Embankment alternative. Any potential "under-rights" are considered too expensive and are not available for implementation at a later date.

<u>Comparisons</u>

An evaluation of cost/level of benefit between alternatives can be made by:

1. Comparing the Modified, Post Hearing, and Depressed Alternatives to the Embankment alternatives,

2. Comparing alternatives to each other.

The following tables compare the incremental cost and the reductions in noise levels and number of takings between each alternative and the Embankment alternative.

COMPARISON TO EMBANKED ALTERNATIVE

	Modified	Post Hearing	Depressed
Incremental Cost (1976 $ million)			
$	75.3	119.2	195.9
%	45	73	118
Reduction in Noise Levels (Average for 6 locations)			
dbA	more than 5	more than 8	more than 8
Difference in # of Takings			
Residential	+9	+8	+1
Commercial	+14	+7	+1
Total	+23	+15	+2

COMPARISON OF ALTERNATIVES

	Modified/ Embanked	Post Hearing/ Modified	Depressed
Incremental Cost (1976 $ million)			
$	75.3	43.9	76.7
%	45	18	27
Reduction in Noise Levels (Average of 6 locations)			
dbA	more than 5	more than 3	none
Reduction in # of Takings			
#	+23	-8	-13
Additional Potential for Development			
acres	n.a.	9.4	4.8
%			

For the locations considered, the Modified alternative provides for better than one-half the average sound pressure level of the Embankment alternative at an added incremental cost of approximately one-half of the construction cost of the Embankment alternative. (A change in 3 db represents a halving of the sound pressure level.) For an additional incremental construction cost of less than 25% of the Embankment alternative cost, the Post Hearing alternative results in approximatley an eight-fold reduction in sound pressure levels.

An additional incremental cost of almost 50% of the Embankment alternative cost does not provide a significant reduction in sound pressure level. Clearly, the Post Hearing alternative provides the best "cost effective" reduction in noise levels.

With respect to the number of takings, the Embankment alternative results in the least number of takings; however, the other negative environmental aspects of that alternative negate this benefit.

The Depressed alternative offers the next least number of takings. However, its cost is more than twice that of the Embankment alternative. The Post Hearing alternative results in a compromise that provides for fewer takings than does the Modified alternative.

Regarding the steepness of final grades as compared to existing grades at selected locations, the Post-Hearing alternative provides, on the average, the best conditions, i.e., conditions of least steepness.

Regarding the extent of fill above existing grades, the Post-Hearing alternative results in significantly reduced levels of fill from the Modified alternative. These are approximately the same levels as those in the Depressed alternative with a resultant 18% increase in cost above the Modified Embankment Alternative.

Summary

It can be stated that the Post-Hearing Alternative has the following characteristics:

1. It provides the most cost effective reduction in noise levels (i.e., virtually identical to the fully depressed alternative)

2. It results in the most gradual street gradients at intersections.

3. It provides minimum heights of fill above existing grades.

4. It provides for the most cost effective addition of air-rights for potential development in the future.

These benefits are true at cost lower than that of the Depressed Alternative, and with a total number of takings which are reduced significantly from the maximum of the alternatives considered.

It should also be reiterated that the Post Hearing profiles represent the preferred alternatives which are the culmination of a long process of detailed consideration. As such, it is the product of consensus selection by public and private individuals concerned with the project, and is the Proposed Project.

(FIG. V-1)
ESTIMATED DAILY RIDERSHIP DEMAND DISTRIBUTION
BY COMMUNITY

(Inbound Boardings-24 hours)

Community	1980 No-Build	1980 Relocated	1995 No-Build	1995 Relocated
Boston Proper	3,480	1,550	3,590	1,600
Brookline	288	310	300	324
Canton	65	72	83	92
Dedham	922	922	966	1,072
Dorchester	2,472	2,427	2,422	2,380
Dover	102	113	122	133
Hyde Park	2,090	2,200	2,257	2,376
Jamaica Plain	5,531	8,530	5,425	8,373
Medfield	96	97	119	120
Milton	82	85	87	90
Needham	178	195	194	213
Newton	26	27	27	28
Norwood	492	497	550	557
Parker Hill/Fenway	296	3,890	299	3,940
Roslindale	3,458	3,802	3,804	3,183
Roxbury	9,520	13,966	9,140	13,408
Sherborn	19	20	31	32
South Boston	1,044	600	990	570
Walpole	90	96	115	123
West Roxbury	2,297	2,430	2,481	2,640
Westwood	591	630	739	790
Other	181	186	214	221
Total	33,320	42,715	33,985	43,265

(FIG. V-2)
ESTIMATED DAILY BOARDINGS AT ORANGE LINE STATIONS

(Inbound Boardings - 24 hours)

Station	1980 No-Build	1980 Relocated	1995 No-Build	1995 Relocated
Forest Hills	13,760	14,585	14,850	15,780
Green Street	1,860	2,330	1,825	2,285
Boylston Street	---	2,110	---	2,070
Egleston	3,660	---	3,555	---
Jackson Square	---	6,580	---	6,380
Dudley	8,390	---	8,090	---
Roxbury Crossing	---	5,330	---	5,190
Ruggles Street	---	8,130	---	7,930
Northampton/Mass. Ave.	3,450	3,650	3,395	3,630
Dover	2,200	---	2,270	---
Sub Total	33,320	42,715	33,985	43,265
Back Bay	---	8,715	---	9,150
South Cove	---	4,585	---	4,725
Total	33,320	56,015	33,985	57,140

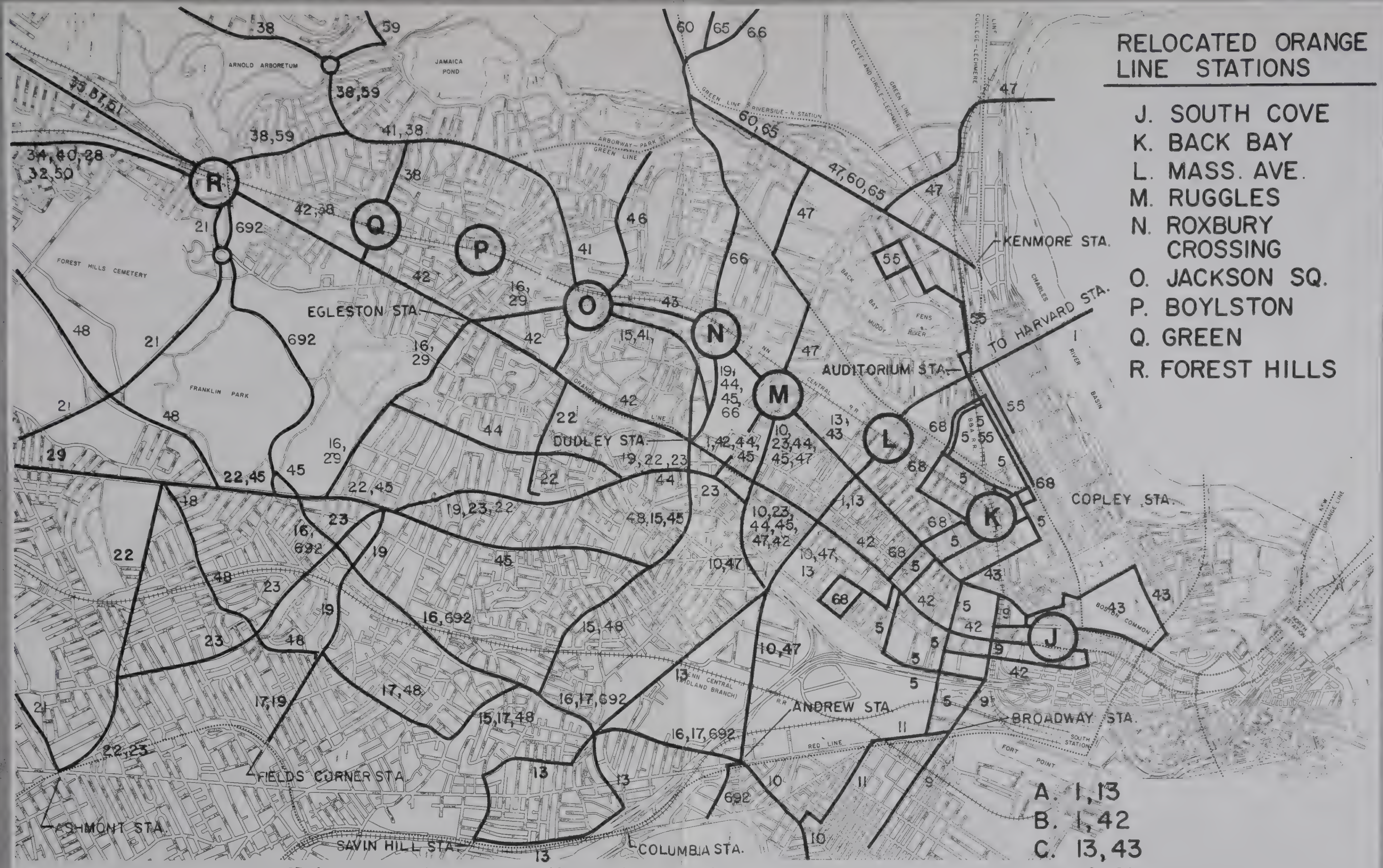
SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

BUS ROUTES

RELOCATED ORANGE LINE



RELOCATED ORANGE LINE STATIONS

J. SOUTH COVE
K. BACK BAY
L. MASS. AVE.
M. RUGGLES
N. ROXBURY CROSSING
O. JACKSON SQ.
P. BOYLSTON
Q. GREEN
R. FOREST HILLS

1. Harvard - Dudley
10. City Point - Ruggles
13. Savin Hill - Ruggles
15. Kane Sq. - Jackson Sq.
16. Andrew Sq. - Jackson Sq.
17. Fields Corner - Andrew Sq.
19. Fields Corner - Ruggles
22. Ashmont - Jackson Sq. via Talbot
23. Ashmont - Ruggles
29. Mattapan - Jackson Sq.
41. Center St. - Dudley
42. Forest Hill - Essex
43. Jackson Sq. - Park St.
44. Seaver St. - Ruggles St. via New Dudley St.
45. Franklin Park - Ruggles St.
46. S. Huntington - Jackson Sq.
47. Andrew Sta. - Central Sq. via Boston City Hosp.
66. Allston - Dudley
68. Boston City Hosp. - Copley Sq.

A. 1, 13
B. 1, 42
C. 13, 43
D. 10, 23, 44, 45, 47
E. 1, 42, 44, 45
F. 19, 44, 45, 66
G. 19, 43, 44, 45

SCALE

0 1200 2400 3600

FIGURE V-4

FREDERIC R. HARRIS INC

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

TRAFFIC 1980

DAILY TRAFFIC VOLUMES ARTERIAL - NO BUILD

SCALE

NORTH

0 1000 2000 3000

FIGURE

V-6

FREDERIC R. HARRIS INC.

DAILY TRAFFIC VOLUMES

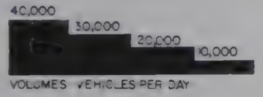
SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

TRAFFIC 1980

DAILY TRAFFIC VOLUMES ARTERIAL TO JACKSON SQUARE



SCALE

NORTH

0 1000 2000 3000

FIGURE

V-7

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

TRAFFIC 1980

DAILY TRAFFIC VOLUMES ARTERIAL TO FOREST HILLS

40,000
30,000
20,000
10,000
VOLUMES VEHICLES PER DAY

NORTH

SCALE

0 1000 2000 3000

FIGURE V-8

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

TRAFFIC 2000

DAILY TRAFFIC VOLUMES ARTERIAL - NO BUILD

SCALE

FIGURE

V-9

FREDERIC R. HARRIS INC.

DAILY TRAFFIC VOLUMES

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

TRAFFIC 2000

DAILY TRAFFIC VOLUMES
ARTERIAL TO JACKSON SQUARE

VOLUMES VEHICLES PER DAY

SCALE

0 1000 2000 3000

FIGURE

V-10

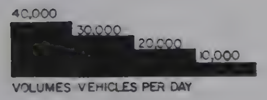
SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

TRAFFIC 2000

DAILY TRAFFIC VOLUMES ARTERIAL TO FOREST HILLS



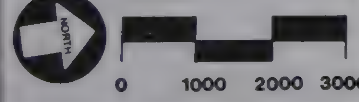


FIGURE
V-11

FREDERIC R. HARRIS INC.

(FIG. V-12)

LOCATIONS OF RAILROAD RIGHT-OF-WAY PEDESTRIAN CROSSINGS SOUTH COVE TO FOREST HILLS

Street	NB-1	SC-1	SC-2	PHP-1	PHP-2
Tremont Street	x	x	x	x	x
Arlington Street	x	x	x	x	x
Berkeley Street	x	x	x	x	x
Columbus Avenue	x	x	x	x	x
Clarendon Street	x	x	x	x	x
Footbridge - Back Bay Station					
Dartmouth Street	x	x	x	x	x
Footbridge - Follen/Braddock Park	x	x	x	x	x
W. Newton Street	x	x	x	x	x
Footbridge - Durham/W. Rutland Sq.	x	x	x	x	x
Mass. Avenue	x	x	x	x	x
Footbridge - Gainsboro/Camden Street	x	x	x	x	x
		11	11		

Street	NB-1	FH-1	FH-2	FH-3	FH-4	FH-5	FH-6	PHP-1	PHP-2
Bus service road		x	x	x	x	x	x	x	x
Ruggles Station		x	x	x	x	x	x	x	x
Ruggles Street	x	x	x	x	x	x	x	x	x
Prentiss Street	x	x	x	x	x	x	x	x	x
Station Street	x	x	x	x	x				
Tremont Street	x	x	x	x	x	x	x	x	x
Cedar Street						x	x	x	x
New Heath Street	x	x	x	x	x	x	x	x	x
Heath Street	x	x	R	x	R	R	R	x	x
Jackson Sq. Station		x	x	x	x	x	x	x	x
Centre Street	x	x	x	x	x	x	x	x	x
Atherton/Mozart Streets	x	x	x	x	x	x	x	x	x
Arterial Crossover					x				
Paul Gore Street		x	x	x					
Boylston Station		x	x	x	x	x	x	x	x
Boylston Street	x	x	x	x	x	x	x	x	x
Footway-Underpass	x								
Lorene Road						x	x	x	x
Minton Street		x	x		x			x	x
Pedestrian Bridge			x			x	x	x	x
Green Street	x	x	x	x	x	x	x	x	x
Green St. Station		x	x	x	x	x	x	x	x
Gordon Street		x	x	x		x	x	x	x
Williams Street	x	x	x	x	x	x	x	x	x
McBride Street	x	x	x	x	x	x	x	x	x
Arterial Crossover					x				
Roadway under Arborway	x	x	x	x	x	x	x	x	x
Morton Street	x								
Forest Hills Station		x	x	x	x	x	x	x	x
Asticou Rd/Walk Hill Rd	x								
Washington Street	x	x	x	x	x	x	x	x	x
TOTAL	28	23	34	22	23	23	23	35	35

R = Relocated

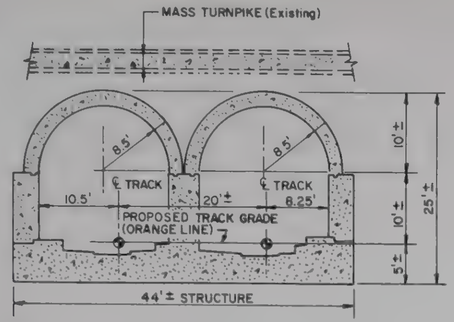
SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

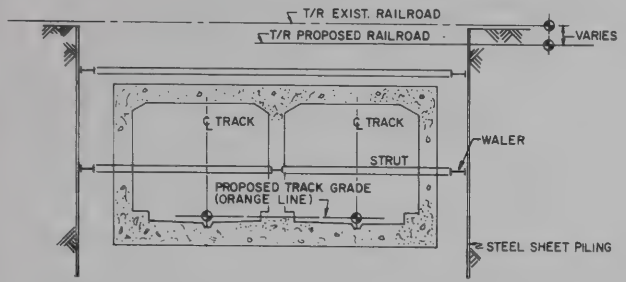
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

CONSTRUCTION DETAILS

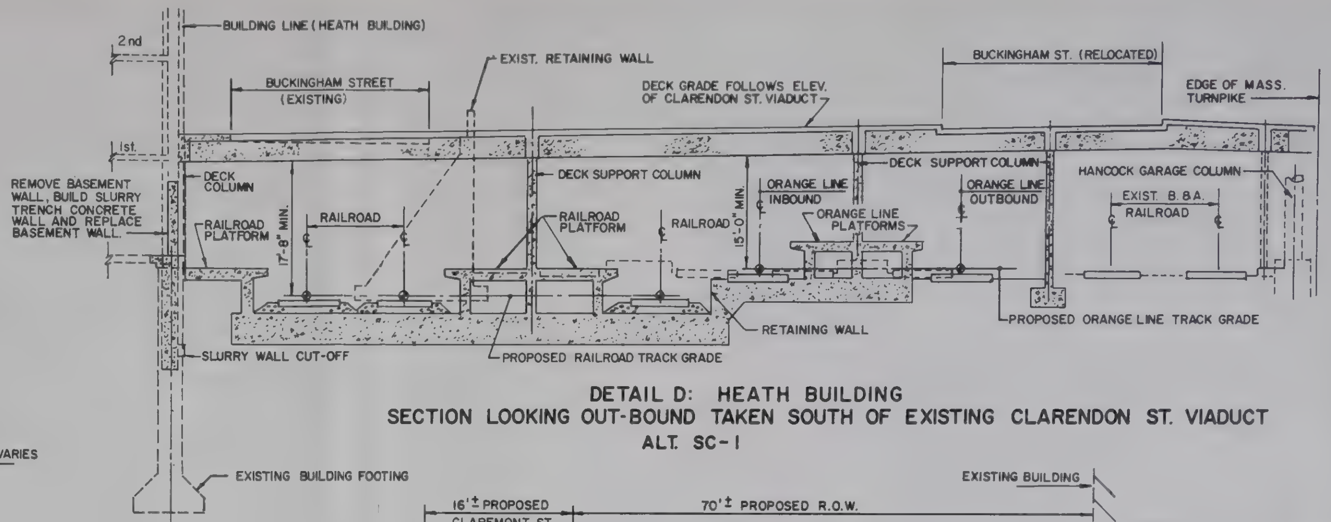
SOUTH COVE
TO
CAMDEN
SC-1



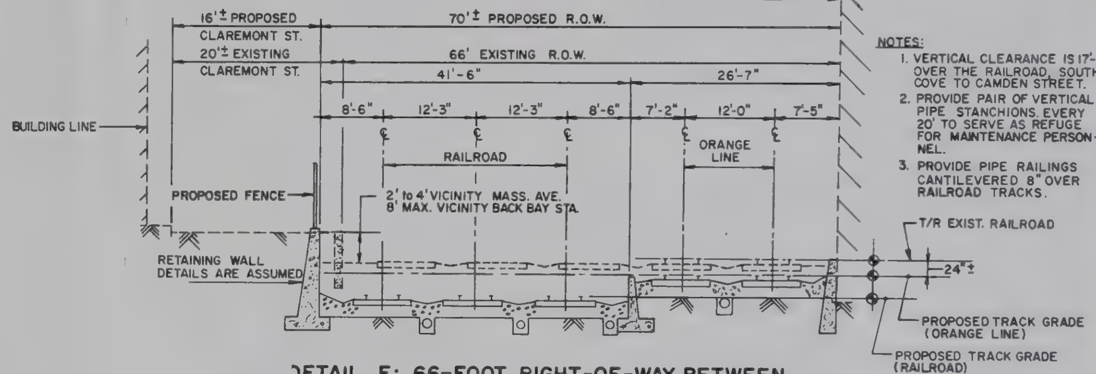
DETAIL A: TWIN-ARCHED TUNNEL
SECTION AT STATION 320+50
(BY OTHERS)



DETAIL B: TRANSITION SECTION TWIN-BOX
SECTION AT STATION 318+00
(BY OTHERS)

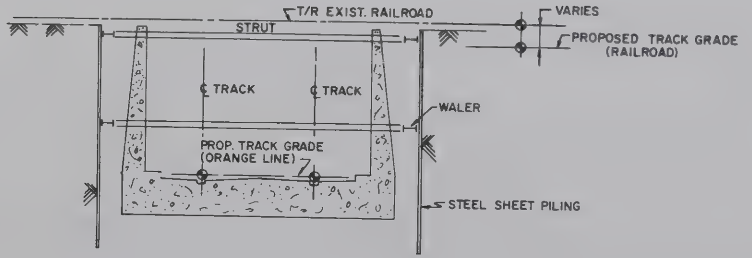


DETAIL D: HEATH BUILDING
SECTION LOOKING OUT-BOUND TAKEN SOUTH OF EXISTING CLARENDON ST. VIADUCT
ALT. SC-1



NOTES:
1. VERTICAL CLEARANCE IS 17'-8" OVER THE RAILROAD, SOUTH COVE TO CAMDEN STREET.
2. PROVIDE PAIR OF VERTICAL PIPE STANCHIONS EVERY 20' TO SERVE AS REFUGE FOR MAINTENANCE PERSONNEL.
3. PROVIDE PIPE RAILINGS CANTILEVERED 8" OVER RAILROAD TRACKS.

DETAIL E: 66-FOOT RIGHT-OF-WAY BETWEEN
BACK BAY STATION & CAMDEN STREET (LOOKING SOUTH)
ALT. SC-1



DETAIL C: U-SHAPED BOAT SECTION
SECTION A STATION 290+00 ALT. SC-1
(BY OTHERS)

GENERAL NOTE:
"RAILROAD" REFERS TO FRA/AMTRAK AND COMMUTER RAILS.

NO SCALE

FIGURE
IV-69

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

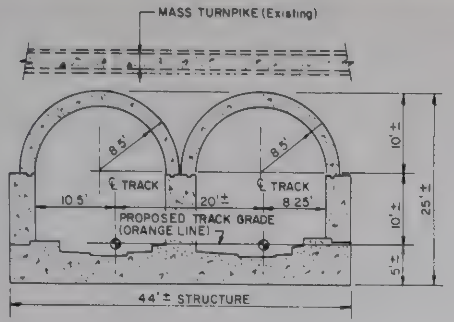
ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

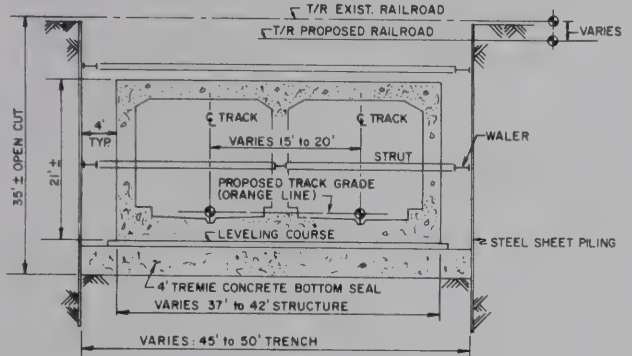
CONSTRUCTION DETAILS

SOUTH COVE
TO
CAMDEN

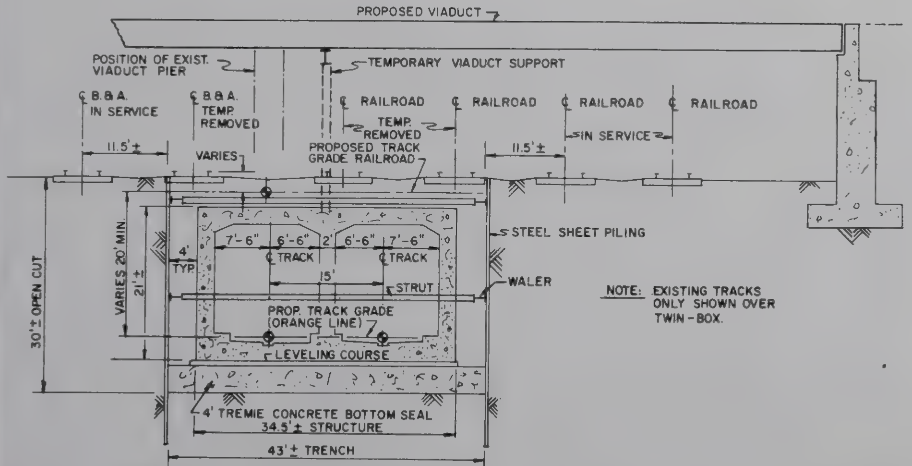
SC-2



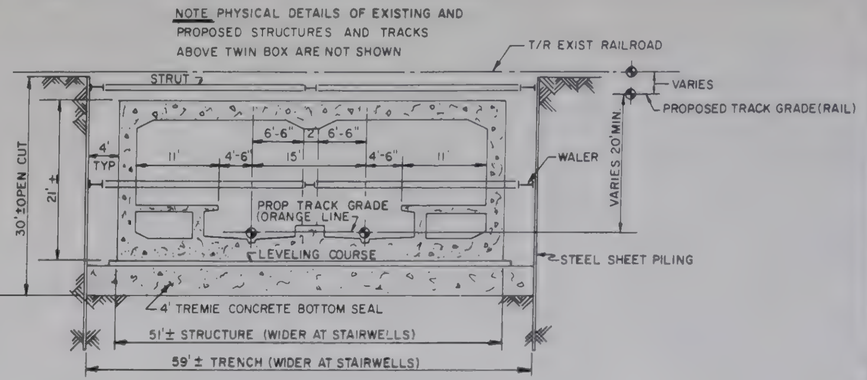
DETAIL A: TWIN-ARCHED TUNNEL
SECTION AT STATION 320+50
(BY OTHERS)



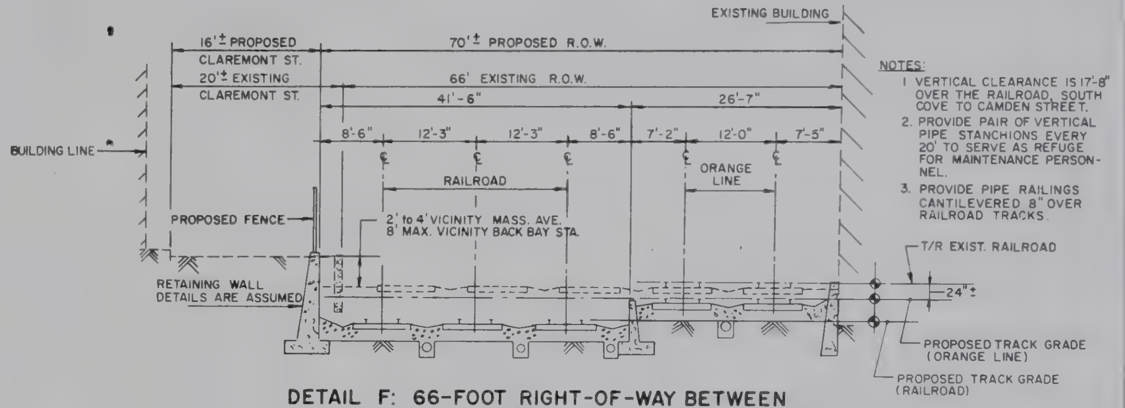
DETAIL B: TRANSITION SECTION TWIN-BOX
SECTION AT STATION 318+00
ALT. SC-2



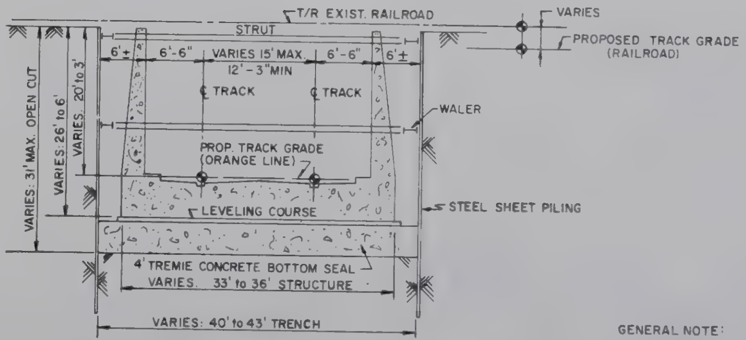
DETAIL C: CLOSE-COUPLED TWIN-BOX
SECTION AT STATION 307+00 ALT. SC-2



DETAIL D: TWIN-BOX WITH SIDE PLATFORMS
SECTION AT STATION 295+00
ALT. SC-2



DETAIL F: 66-FOOT RIGHT-OF-WAY BETWEEN
BACK BAY STATION & CAMDEN STREET (LOOKING SOUTH)
ALT. SC-2



DETAIL E: U-SHAPED BOAT SECTION
SECTION A STATION 290+00 ALT. SC-2

GENERAL NOTE:
"RAILROAD" REFERS TO FRA/AMTRAK AND COMMUTER RAILS

NO SCALE	FIGURE IV-69A

FREDERIC R. HARRIS INC

CONSTRUCTION DURATION

COMBINED ALTERNATIVES	ALTERNATIVE DESIGNATION		CONSTRUCTION DURATION-SOUTH COVE TO FOREST HILLS							
	South Cove to Camden St.	Camden St. to Forest Hills	South Cove to Camden St.		Camden St. to Forest Hills: Camden St. to Mozart St.		Camden St. to Forest Hills: Mozart St. to Forest Hills		Total Project Time	
			Yr.	Mo.	Yr.	Mo.	Yr.	Mo.	Yr.	Mo.
• NO BUILD RAIL/TRANSIT, NO BUILD ARTERIAL STREET	NB-1	NB-1								
• DEPRESSED RAIL/TRANSIT, NO ARTERIAL STREET	-	FH-1								
- with minimum grade adjustments, all tracks	SC-1	-	2	3	2	9	2	9	3	9
- with Orange Line in tunnel to Dartmouth Street	SC-2	-	2	6	2	9	2	9	3	9
- with Forest Hills Station elevated (option)	-	FH-1a	2	3	2	9	2	6	3	6
• DEPRESSED RAIL/TRANSIT, ARTERIAL STREET EAST	-	FH-2								
- with minimum grade adjustments, all tracks	SC-1	-	2	3	2	9	2	9	3	9
- with Orange Line in tunnel to Dartmouth Street	SC-2	-	2	6	2	9	2	9	3	9
- with Forest Hills Station elevated (option)	-	FH-2a	2	3	2	9	2	6	3	6
- with Arterial to Jackson Square only (2 options)	-	FH-2b, 2c	2	3	2	9	2	9	3	9
• RAIL/TRANSIT ON MODIFIED EMBANKMENT, NO ARTERIAL ST.	-	FH-3								
- with minimum grade adjustments for all streets	SC-1	-	2	3	2	0	2	0	2	6
- with Orange Line in tunnel to Dartmouth Street	SC-2	-	2	6	2	0	2	0	2	9
• RAIL/TRANSIT ON MODIFIED EMBANKMENT, ARTERIAL CROSSING EAST TO WEST	-	FH-4								
- with minimum grade adjustments, all tracks	SC-1	-	2	3	2	0	2	0	2	6
- with Orange Line in tunnel to Dartmouth Street	SC-2	-	2	6	2	3	2	3	2	9
- with Arterial to Jackson Square only (2 options)	-	FH-4a, 4b	2	3	2	0	2	0	2	6
• MODIFIED-DEPRESSED RAIL/TRANSIT, ARTERIAL STREET EAST	-	FH-5								
- with minimum grade adjustments, all tracks	SC-1	-	2	3	3	0	2	9	4	0
- with Orange Line in tunnel to Dartmouth Street	SC-2	-	2	6	3	0	2	9	4	0
• MODIFIED-DEPRESSED RAIL/TRANSIT, NO ARTERIAL SOUTH OF JACKSON SQUARE	-	FH-6, 6a								
- with minimum grade adjustments, all tracks	SC-1	-	2	3	3	0	2	3	4	0
- with Orange Line in tunnel to Dartmouth Street	SC-2	-	2	6	3	0	2	3	4	0
• POST HEARING PROFILE ARTERIAL STREET, NO ARTERIAL SOUTH OF JACKSON SQUARE	PHP-1		2	3	3	0	2	9	4	0
• POST HEARING PROFILE, ARTERIAL STREET EAST	PHP-2		2	3	3	0	2	9	4	0

NOTES: 1. Total project time assumes railroad service on Midland Branch during construction.
2. If railroad service is to be maintained to Back Bay Station, assume a temporary trestle and add 15 months to all project times.

(FIG. V - 14)

ALTERNATIVE CONSTRUCTION COSTS

COMBINED ALTERNATIVES	ALTERNATIVE DESIGNATION		ESTIMATED CONSTRUCTION COST				
	South Cove to Camden St.	Camden Street to Forest Hills	South Cove to Camden Street Rail/Transit	Camden St. to Forest Hills Rail/Transit	South Cove to Forest Hills Street Work	30% Engineering & Contingencies	Total Alternative Cost
• No Build Rail/Transit	NB-1	NB-1					
• Depressed Rail/Transit, No Arterial Street	--	FH-1					
- with minimum grade adjustments, all tracks	SC-1	FH-1	(5) $ 45,198,000	$ 222,897,000	$ 9,124,000	$ 83,466,000	$361,685,000
- with Orange Line in tunnel to Dartmouth Street	SC-2	FH-1	63,516,000	222,897,000	9,199,000	88,684,000	384,296,000
- with Forest Hills Station elevated (option)	--	FH-1a	-	(1)	(1)	-	
• Depressed Rail/Transit, Arterial Street East	--	FH-2					
- with minimum grade adjustments, all tracks	SC-1	FH-2	(5) 45,198,000	222,897,000	17,455,000	85,665,000	371,215,000
- with Orange Line in tunnel to Dartmouth Street	SC-2	FH-2	63,516,000	222,897,000	17,530,000	90,883,000	393,826,000
- with Forest Hills Station elevated (option)	--	FH-2a	-	(2)	(2)	-	
- with Arterial to Jackson Square only (option)	--	FH-2b,2c	-	-	(3)	-	
• Rail/Transit on Modified Embankment, No Arterial Street	--	FH-3					
- with minimum grade adjustments for all tracks	SC-1	FH-3	(5) 45,198,000	75,651,000	5,634,000	37,945,000	164,428,000
- with Orange Line in tunnel to Dartmouth Street	SC-2	FH-3	63,516,000	75,651,000	5,709,000	43,463,000	188,339,000
• Rail/Transit on Modified Embankment, Arterial Crossing East to West	--	FH-4					
- with minimum grade adjustments, all tracks	SC-1	FH-4	(5) 45,198,000	75,273,000	16,388,000	41,028,000	177,787,000
- with Orange Line in tunnel to Dartmouth Street	SC-2	FH-4	63,516,000	75,273,000	16,463,000	46,576,000	201,828,000
- with Arterial to Jackson Square only (options)	--	FH-4a,4b	-	-	(4)	-	
• Modified Depressed Rail/Transit, Arterial East	--	FH-5					
- with minimum grade adjustments, all tracks	SC-1	FH-5	(5) 45,198,000	126,179,000	20,445,000	57,547,000	249,369,000
- with Orange Line in tunnel to Dartmouth Street	SC-2	FH-5	63,516,000	126,179,000	20,520,000	63,065,000	273,280,000
• Modified Depressed Rail/Transit, No Arterial Street South of Jackson Square	--	FH-6					
- with minimum grade adjustments, all tracks	SC-1	FH-6, 6a	(5) 45,198,000	122,693,000	18,479,000	55,911,000	242,281,000
- with Orange Line in tunnel to Dartmouth Street	SC-2	FH-6,6a	63,516,000	122,693,000	18,554,000	61,492,000	266,193,000
• Post Hearing Profile, No Arterial Street	PHP-1		46,198,000	170,171,000	18,479,000	70,455,000	305,303,000
• Post Hearing Profile, Arterial Street East	PHP-2		46,198,000	170,927,000	20,445,000	71,271,000	308,841,000

NOTES TO (FIG. V-14)

(1) Deduct $26,828,000 from Rail/Transit Cost; deduct $785,000 from Street Cost.

(2) Deduct $26,828,000 from Rail/Transit Cost; deduct $1,367,000 from Street Cost.

(3) Deduct $4,012,000 from Street Cost.

(4) Deduct $6,787,000 from Street Costs.

(5) Does not include $7,625,000 for South Cove Project Cost west of Massachusetts Turnpike Station 313+00 to Station 3 +00.

(6) All costs are expressed in 1976 dollars.

General Notes

(7) The demolition of the Existing Orange Line from Forest Hills to the South Portal, add to the total cost $1,440,000.

(8) All estimates assume utilization of an upgraded Midlands Branch Railroad which construction cost of $16,000,000 is not included, since it is the subject of a previous capital grant.

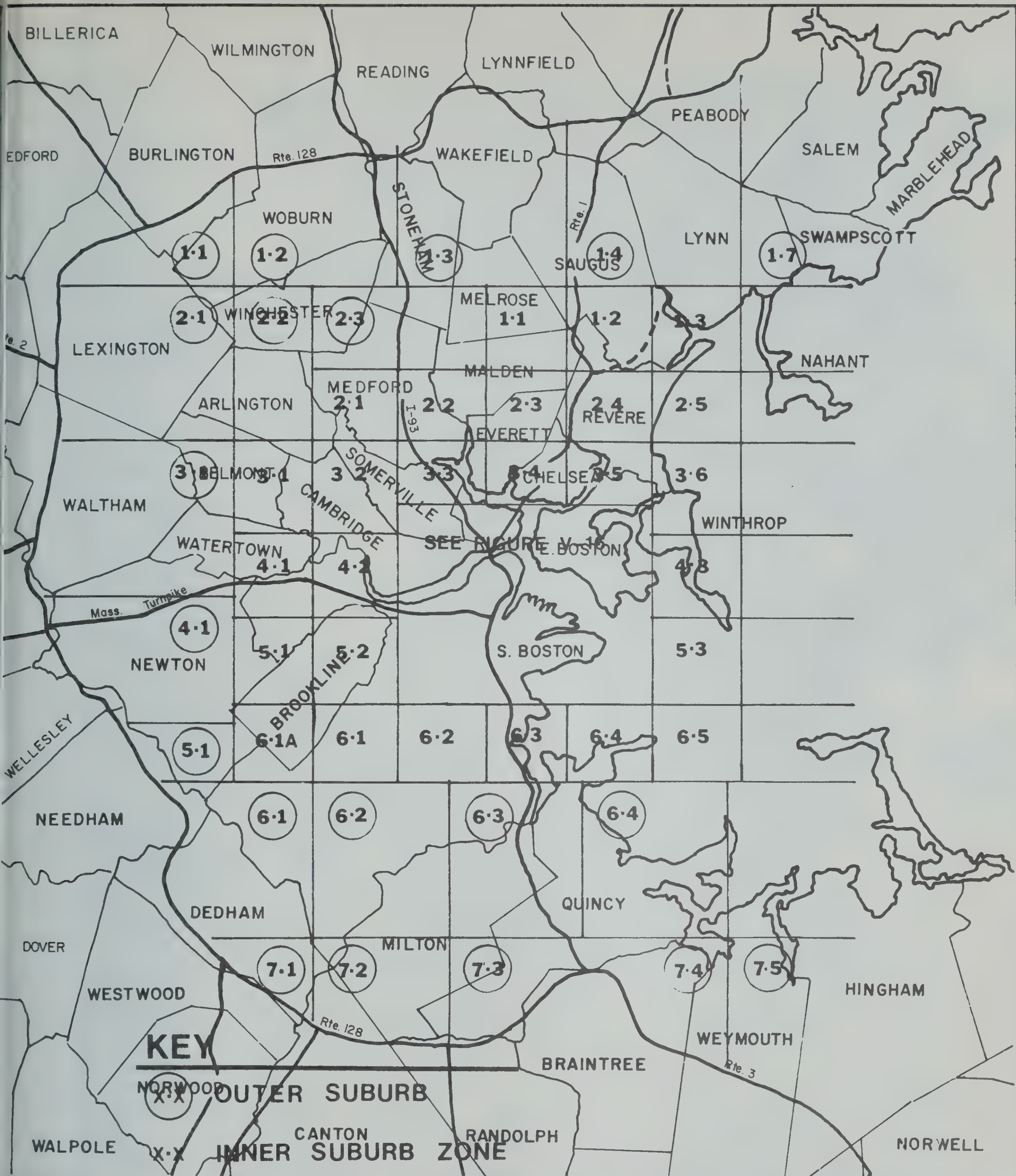
(9) If Commuter Rail service is to be maintained to Back Bay Station, a trestle cost of $69,710,000 must be added to all estimates (cost includes Engineering and contingencies).

(10) Street work includes all arterial streets, street bridges, miscellaneous street work and streets around stations.

(11) Rail Bridge demolition and new rail/transit and street bridge construction included in rail/transit costs.

(12) Cost Estimates do not include land takings.

(13) Operating costs for all options are similar.



BOSTON AIR QUALITY STUDY GRID CELL CONFIGURATION

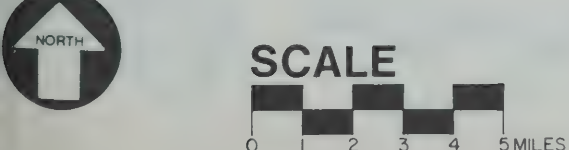
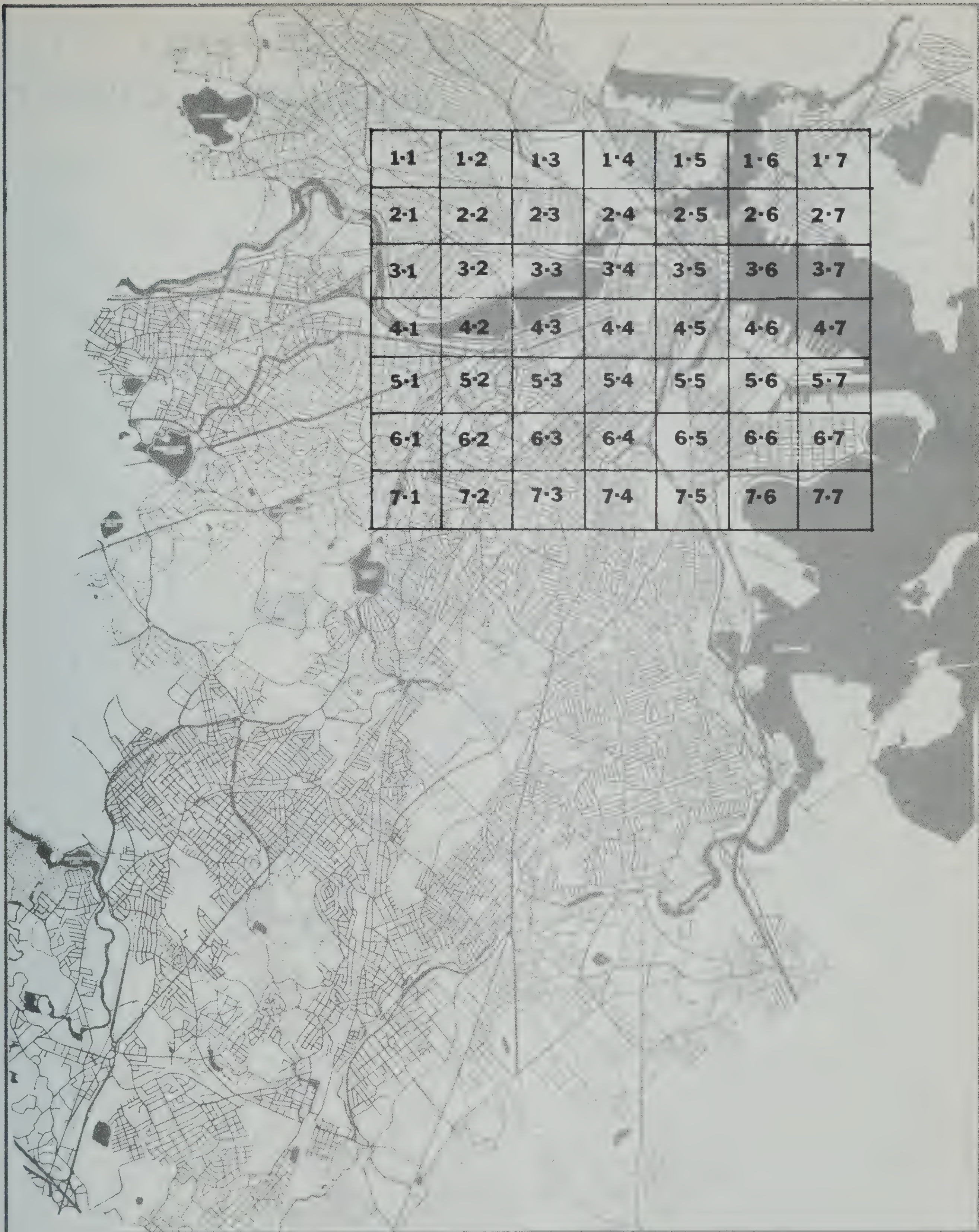


FIGURE V-15



GRID CELL CONFIGURATION INNER CITY AREA

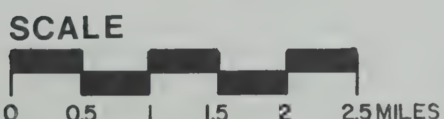


FIGURE V-16

PRIMARY LINK NETWORK
NO-BUILD ALTERNATIVE

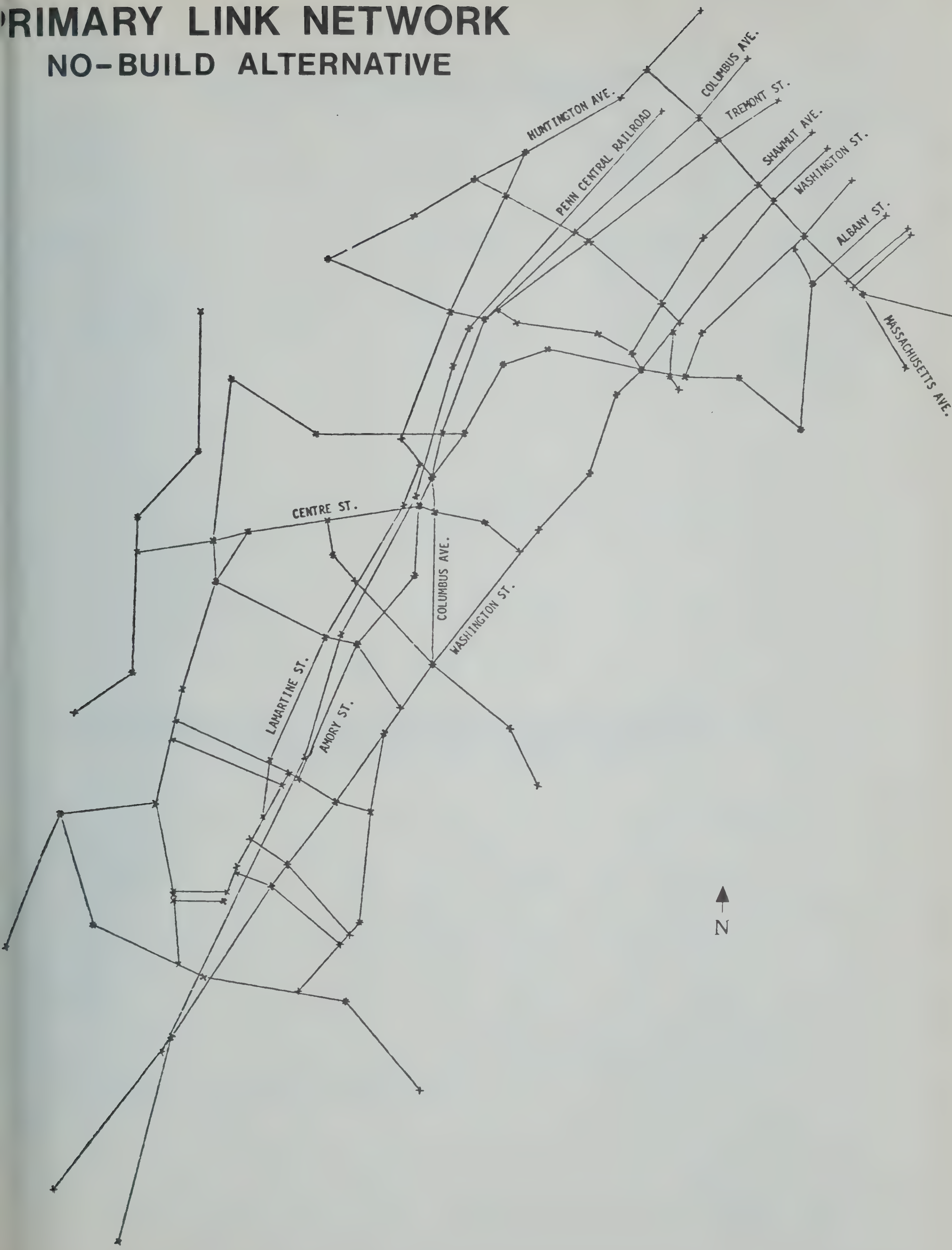


FIGURE V-17

(FIG. V-18)

TOTAL DAILY VEHICLE MILES TRAVELED (VMT), PROJECT AREA PRIMARY LINK NETWORK

Alternative	1975	Year 1980	2000
No Build	482,2666	484,986	487,706
FH-2b, FH-6, PHP-1	481,307	484,027	495,347
FH-2, FH-5, PHP-2	491,016	493,736	515,565
FH-4	489,806	492,526	513,165

(FIG. V-19)

EMISSION FACTORS* FOR CARBON MONOXIDE, HYDROCARBONS, AND NITROGEN OXIDES (IN GRAMS/VEHICLE MILE) FOR CALENDAR YEARS 1975, 1980, 2000

Calendar Year	CO		HC		NO_x	
	Road	Track	Road	Track	Road	Track
1975	48.4	30.8	6.1	22.0	4.1	33.0
1980	22.2	30.8	2.6	22.0	2.4	33.0
2000	12.9	30.8	1.6	22.0	1.2	33.0

*Assumed vehicle speed is 20 mph, assumed vehicle mix is 5 percent heavy-duty vehicles.

(FIG. V-20)

TOTAL EMISSIONS OF CARBON MONOXIDE, HYDROCARBONS, NITROGEN OXIDES FROM PRIMARY LINK NETWORK (100 TONS/YEAR)

Alternative*	1975								
	CO			HC			NO_x		
	Road	Track	Total	Road	Track	Total	Road	Track	Total
No Build	93.6	.2	93.8	11.7	.2	11.9	7.9	.3	8.2
FH-2b, FH-6, PHP-1	93.4	.2	93.6	11.7	.2	11.9	7.9	.3	8.2
FH-2, FH-5, PHP-2	95.3	.2	95.5	11.9	.2	12.1	8.1	.3	8.4
FH-4	95.0	.2	95.2	11.9	.2	12.1	8.1	.3	8.4

*See Section 5.3.4 for a description of project alternatives.

(FIG. V-21)

TOTAL EMISSIONS OF CARBON MONOXIDE, HYDROCARBONS NITROGEN OXIDES FROM PRIMARY LINK NETWORK (100 TONS/YEAR)

Alternative*	1980								
	CO			HC			NO_x		
	Road	Track	Total	Road	Track	Total	Road	Track	Total
No Build	43.0	.3	43.3	5.1	.2	5.3	4.6	.3	4.9
FH-2b, FH-6, PHP-1	43.0	.3	43.3	5.1	.2	5.3	4.6	.3	4.9
FH-2, FH-5 PHP-2	43.8	.3	44.1	5.2	.2	5.4	4.7	.3	5.0
FH-4	43.7	.3	44.0	5.2	.2	5.4	4.7	.3	5.0

*See Section 5.3.4 for a description of project alternatives.

(FIG. V-22)

TOTAL EMISSIONS OF CARBON MONOXIDE, HYDROCARBONS, NITROGEN OXIDES FROM PRIMARY LINK NETWORK (100 TONS/YEAR)

Alternatives*	2000								
	CO			HC			NO_x		
	Road	Track	Total	Road	Track	Total	Road	Track	Total
No Build	25.0	.3	25.3	3.2	.2	3.4	2.4	.3	2.7
FH-2b, FH-6, PHP-1	25.4	.3	25.7	3.2	.2	3.4	2.4	.3	2.7
FH-2, FH-5 PHP-2	26.4	.3	26.7	3.4	.2	3.6	2.5	.3	2.8
FH-4	26.3	.3	26.6	3.4	.2	3.6	2.5	.3	2.8

*See Section 5.3.4 for a description of project alternatives.

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

STUDY AREA

LOCATION OF CO CONCENTRATION CROSS-SECTIONS IN THE SOUTHWEST CORRIDOR

SCALE
0 1200 2400 3600
NORTH

FIGURE V-23

LOCATION CO CONCENTRATION X-SECTIONS

(FIG. V-24)

MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS FOR ALL PROJECT ALTERNATIVES ALONG SELECTED CROSS-SECTIONS IN THE YEAR 1975

Cross Section+	Alternatives* No Build	FH-2b FH-6 PHP-1	FH-2 FH-5 PHP-2	FH-4
1	14.98	14.98	14.91	14.88
2	11.91	11.91	15.53	15.54
3	6.73	6.73	18.77	18.77
4	8.41	8.41	21.46	21.57
5	17.67	28.08	30.69	30.69
6	27.75	28.12	31.16	31.16
7	13.94	27.68	30.94	30.94

*See Section 4.3.4
+See Figure V-23

(FIG. V-25)

MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS FOR ALL PROJECT ALTERNATIVES ALONG SELECTED CROSS-SECTIONS IN THE YEAR 2000

Cross Section+	Alternatives* No Build	FH-2b FH-6 PHP-1	FH-2 FH-5 PHP-2	FH-4
1	6.91	6.91	6.86	6.84
2	5.48	5.48	7.15	7.15
3	3.09	3.09	8.63	8.63
4	3.96	3.96	9.87	10.01
5	8.13	12.92	14.11	14.11
6	12.76	12.94	14.33	14.33
7	6.27	12.73	14.23	14.23
8	2.07	4.46	4.46	4.46
9	1.35	3.26	3.26	3.26
10	5.70	5.76	5.76	5.76

*See Section 5.3.4
+See Figure V-23

(FIG. V-26)

MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS FOR ALL PROJECT ALTERNATIVES ALONG SELECTED CROSS-SECTIONS IN THE YEAR 2000

Cross Section+	Alternatives* No Build	FH-2b FH-6 PHP-1	FH-2 FH-5 PHP-2	FH-4
1	4.02	4.02	6.41	6.40
2	3.18	3.18	6.09	6.09
3	1.80	1.80	6.18	6.18
4	1.90	1.90	6.12	6.20
5	4.72	9.16	9.09	9.09
6	7.41	7.41	9.21	9.21
7	4.00	9.07	9.16	9.16

*See Section 5.3.4
+See Figure V-23

(FIG. V-27)

MAXIMUM 8-HOUR CARBON MONOXIDE CONCENTRATIONS FOR ALL PROJECT ALTERNATIVES ALONG SELECTED CROSS-SECTION IN THE YEAR 1975

Cross Section+	Alternatives* No Build	FH-2b FH-6	FH-2 FH-5	FH-4
1	8.99	8.99	8.95	8.93
2	7.15	7.15	9.32	9.32
3	4.04	4.04	11.26	11.26
4	5.05	5.05	12.88	12.94
5	10.60	16.85	18.41	18.41
6	16.65	16.87	18.70	18.70
7	8.36	16.61	18.56	18.56

*See Section 5.3.4
+See Figure V-23

(FIG. V-28)

MAXIMUM 8-HOUR CARBON MONOXIDE CONCENTRATIONS FOR ALL PROJECT ALTERNATIVES ALONG SELECTED CROSS-SECTIONS IN THE YEAR 1980

Cross Section+	Alternatives* No Build	FH-2b FH-6	FH-2 FH-5	FH-4
1	4.15	4.15	4.12	4.10
2	3.29	3.29	4.29	4.29
3	1.85	1.85	5.18	5.18
4	2.38	2.38	5.92	6.01
5	4.88	7.75	8.47	8.47
6	7.66	7.76	8.60	8.60
7	3.76	7.64	8.54	8.54

*See Section 5.3.4
+See Figure V-23

(FIG. V-29)

MAXIMUM 8-HOUR CARBON MONOXIDE CONCENTRATIONS FOR ALL PROJECT ALTERNATIVES ALONG SELECTED CROSS-SECTIONS IN THE YEAR 2000

Cross Section+	Alternatives* No Build	FH-2b FH-6 PHP-1	FH-2 FH-5 PHP-2	FH-4
1	2.41	2.41	3.85	3.84
2	1.91	1.91	3.65	3.65
3	1.08	1.08	1.18	3.71
4	1.14	1.14	3.67	3.72
5	2.83	5.50	5.45	5.45
6	4.45	4.45	5.53	5.53
7	2.40	5.44	5.50	5.50

*See Section 5.3.4
+See Figure V-23

(FIG. V-30)

RESIDUAL OIL FUEL USE BY STATIONARY SOURCES

Stationary Source Category	Fuel Use (10^3 gal)	Percent Orange Line Increment
Orange Line Increment (1980)	87.2	100%
Total MBTA Generating Stations (1972)	23,944	0.36%
Total Metropolitan Boston (1972)	2,142,328	0.004%

(FIG. V-31)

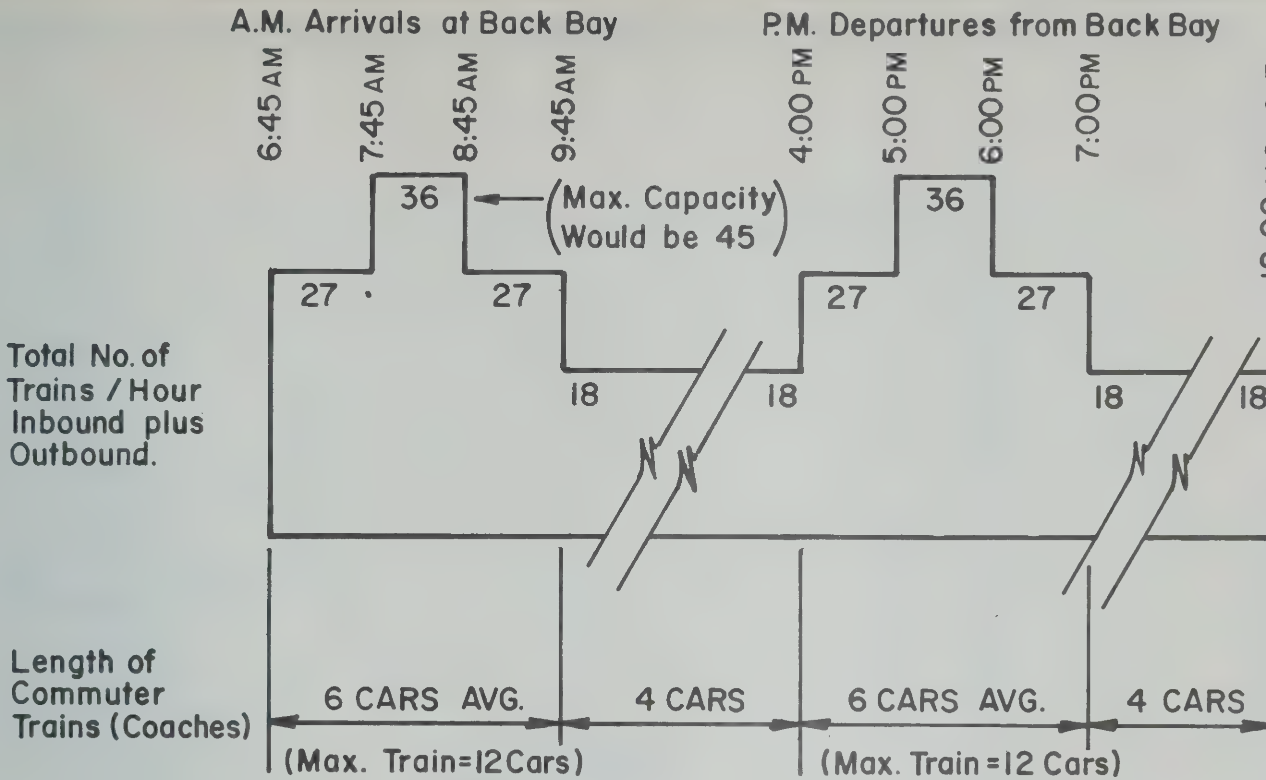
SUMMARY OF PLANNED DEVELOPMENT BY NEIGHBORHOOD

Section		Other	Light Man'f (Sq. Ft)	Retail (Sq. Ft)	Office (Sq. Ft)	Housing Units
Roxbury Section	Low:	4000 std Com. Col.	398750	110000	109000	510
	High:	4000 std Com. Col.	398750	234000	354000	1450
Jamaica Plain: Build Option		SWII High School		33000	0	65
	C1			12000	-OR-	-100
	C2		40000		-OR-	25
	C4XW			20000	-OR-	15
Jamaica Plain: No-Build Option		SWII High School		71000	0	65
	B1			20000	-OR-	-150
	B2		20000		-OR-	15
	B4XW			20000	-OR-	15
South End-Mass. Ave. Station						
	Low:			3000		
	High:			40000	160000	
Back Bay Station						
	Low:			3000		
	High:				400000	

(FIG. V-32)

STATIONARY SOURCE EMISSION LOADINGS FROM DEVELOPMENT

Neighborhood		Tons of Pollutant Emissions per Year PM	NO_x	SO_2	HC	CO
Jamaica Plain Build Option	Low:	2.59	7.00	14.44	0.46	0.47
	High:	4.12	8.72	20.54	0.73	0.97
Jamica Plain No-Build Option	Low:	3.45	9.34	23.73	0.57	0.48
	High:	4.67	10.77	30.53	0.86	1.14
Roxbury	Low:	19.13	29.47	73.70	3.07	2.39
	High:	32.11	57.08	172.62	5.87	6,09
South End, Mass. Ave. Station	Low:	0.06	0.19	0.68	0.01	0.00
	High:	3.97	10.57	45.60	0.54	0.09
Back Bay Station	Low:	0.06	0.16	0.68	0.01	0.00
	High:	7.95	21.14	91.20	1.08	0.18
Total, with Jamaica Plain Build Option	Low:	21.84	36.82	89.50	3.55	2.86
	High:	48.15	97.51	329.96	8.22	7.33
Total, with Jamaica Plain No-Build Option	Low:	22.70	39.16	98.79	3.66	2.87
	High:	48.70	99.56	339.95	8.35	7.50
Total, 30 Inner Cities an Towns in Metropolitan Boston (1970)		28919	156481	252778	168650	707599



Notes: 1) AMTRAK Trains are included in the number of trains shown above.

Assume 6 (total for both directions) at 12 cars in peak hour (AM & PM)
Assume 2 (total for both directions) at 8 cars per hour in off-peak periods
Assume 6 (total for both directions) at 6 cars between midnight and 6:45 AM.

2) In the peak periods assume 2 trains in the peak direction for every 1 in the reverse direction. Thus in the AM peak hour each RR track would carry 12 trains giving a total of 24 inbound and 12 outbound, for a 3 track configuration.

3) Assuming the AMTRAK Route is electrified, all their trains plus the Boston-Providence and 128 Local Commuter trains would be electric locomotive hauled. This would result in 1/2 of the trains being electric during each time period. Of the remaining commuter trains 1/2 would be diesel locomotive hauled and 1/2 self-propelled diesel cars.

SOUTHWEST CORRIDOR-SHORE LINE COMMUTER AND AMTRAK SCHEDULE

HIGH LEVEL OF SERVICE

YEAR 2000

FIGURE

V-33

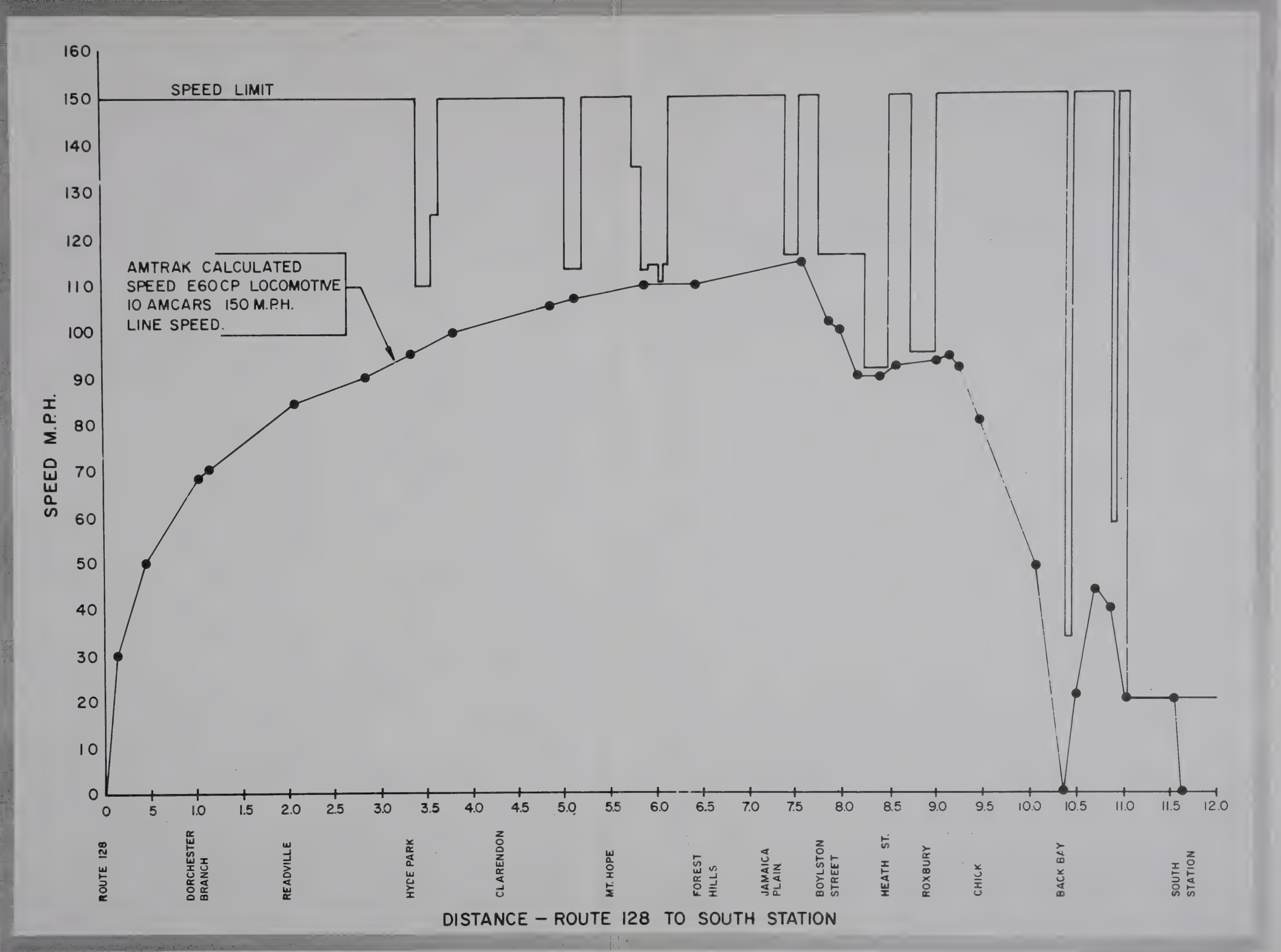
SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

CALCULATED AMTRAK SPEED

V-34



FREDERIC R. HARRIS INC

CALCULATED AMTRAK SPEED

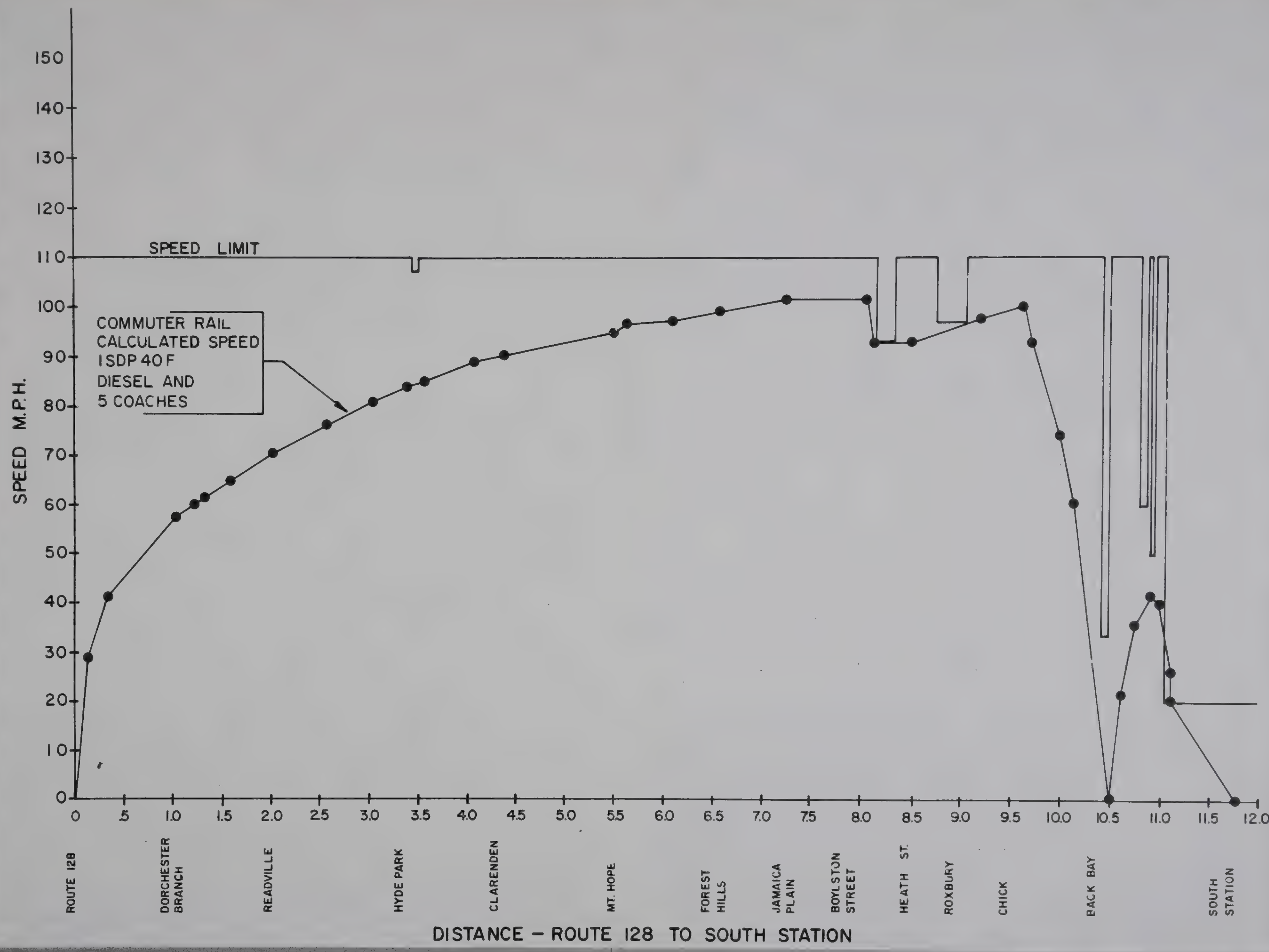
SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

CALCULATED COMMUTER RAIL SPEED

V-34A



CALCULATED COMMUTER RAIL SPEED

(FIG. V-35)

DESIGN NOISE LEVEL/ACTIVITY RELATIONSHIPS

Activity Category	Design Noise Levels-dBA $L_{eq}(h)$	$L_{10}(h)$	Description of Activity Category
A	57 (Exterior)	60 (Exterior)	Tracts of land in which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, or open spaces which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	67 (Exterior)	70 (Exterior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas, and parks.
C	72 (Exterior)	75 (Exterior)	Developed lands, properties or activities not included in categories in A and B above.
D	--	--	For requirements on undeveloped lands see paragraphs 10a. and C.
E	52 (Interior)	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

(FIG. V-35A) (continued)

NOISE LEVELS VS. DISTANCE FROM CORRIDOR

(● Indicates Critical Receptor Location)

Distance			200'	150'	100'	50'	50'	100'	150'	200'
			WEST				EAST			
Location	**Alternative**		**Noise Level**							
Mission Hill (#4)	Embankment	FH-4 ART	<67	<67	<67	● 67	<72	<72	<72	<67
		FH-3 N-ART	<72	<72	<72	● 72	<72	67	<67	<67
	Modified	FH-5 ART	<62	<62	<62	● 62	<72	<72	<67	62
		FH-6 N-ART	<62	<62	<62	● 62	<72	<72	<67	62
	Depressed	FH-2 ART	<62	<62	<62	● <67	<72	<72	<72	<67
		FH-1 N-ART	<62	<62	<62	● 62	<62	<62	<62	<62
	W = From W-side of tracks; E = ART : From E-sidewalk Arterial St. E = N-ART: From E-sidewalk Columbus Ave									
Bromley-Heath (#5)	Embankment	FH-4 ART	<67	<67	<67	● <72	>72	<72	<72	<67
		FH-3 N-ART	<67	<67	<67	● <72	<72	<67	<67	<62
	Modified	FH-5 ART	<62	<62	<62	● <62	<72	<72	<67	<67
		FH-6 N-ART	<62	<62	<62	● <62	<72	<67	<67	<67
	Depressed	FH-2 ART	<62	<62	<62	● <67	<72	<72	<67	<67
		FH-1 N-ART	<62	<62	<62	● <62	<62	<62	<62	<62
	W = From retaining wall; E = ART : From E-sidewalk Arterial St. E = N-ART: From E-sidewalk Centre St.									
College Site (#6)	Embankment	FH-4 ART	<62	<62	<62	<67	>72	● <72	<72	<72
		FH-3 N-ART	<62	<62	<67	<72	<72	● <72	<67	<67
	Modified	FH-5 ART	<62	<62	<67	<72	<72	● <72	<67	<67
		FH-6 N-ART	<62	<62	<67	<72	<72	● <72	<67	<67
	Depressed	FH-2 ART	<62	<62	<62	<67	<72	● <72	<67	<67
		FH-1 N-ART	<62	<62	<62	<67	<62	● <62	<62	<62
	W = From W-side of tracks; E = ART : From E-sidewalk Arterial St. = N-ART: From E-sidewalk Columbus Ave									

(FIG. V-35A)

NOISE LEVELS VS. DISTANCE FROM CORRIDOR

(● Indicates Critical Receptor Location)

Distance			WEST 200'	WEST 150'	WEST 100'	WEST 50'	EAST 50'	EAST 100'	EAST 150'	EAST 200'
Location	**Alternative**		**Noise Level**							
High School S.W. II (#1)	Embankment	FH-4 ART	<62	<67	<67	<72	● >72	<62	<62	<62
		FH-3 N-ART	<67	<67	<62	<62	● >72	<62	<62	<62
	Modified	FH-5 ART	<72	<67	<67	<67	● >72	<62	<62	<62
		FH-6 N-ART	<62	<62	<67	<67	● <72	<62	<62	<62
	Depressed	FH-2 ART	<62	<62	<67	<72	● >72	<62	<62	<62
		FH-1 N-ART	<62	<62	<67	<67	● <72	<62	<62	<62
	All distances from edges of tracks.									
Boylston Congregational Church (#2)	Embankment	FH-4 ART	<62	<67	<72	<72	<72	<72	● <67	<62
		FH-3 N-ART	<72	<67	<72	>72	>72	<72	● <67	<67
	Modified	FH-5 ART	<62	<67	<72	<72	<67	<67	● <67	<62
		FH-6 N-ART	<62	<67	<67	<67	<72	<67	<67	● <62
	Depressed	FH-2 ART	<62	<62	<67	<72	<72	<67	● <62	<62
		FH-1 N-ART	<62	<62	<62	<62	<62	<62	<62	● <62
	All distances from edges of tracks.									
Amory Street Apartments (#3)	Embankment	FH-4 ART	<72	<72	>72	>72	<72	<72	● <67	<62
		FH-3 N-ART	<72	<72	>72	>72	>72	>72	>72	● <72
	Modified	FH-5 ART	<67	<67	<72	<72	<72	<72	<67	● <67
		FH-6 N-ART	<67	<67	<67	<72	>72	<72	<72	● <67
	Depressed	FH-2 ART	<62	<67	<67	<72	<72	<72	<67	● <67
		FH-1 N-ART	<62	<62	<67	<67	<67	<62	<62	● <62

W = From W-side of tracks; E = ART: From E-sidewalk of Arterial
N-ART: From E-side of tracks

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

STUDY AREA

PUBLIC HOUSING PROJECTS

LEGEND

- RELOCATED ORANGE LINE
- EXISTING ORANGE LINE
- (X) PUBLIC HOUSING PROJECTS LOCATION & IDENTICATION

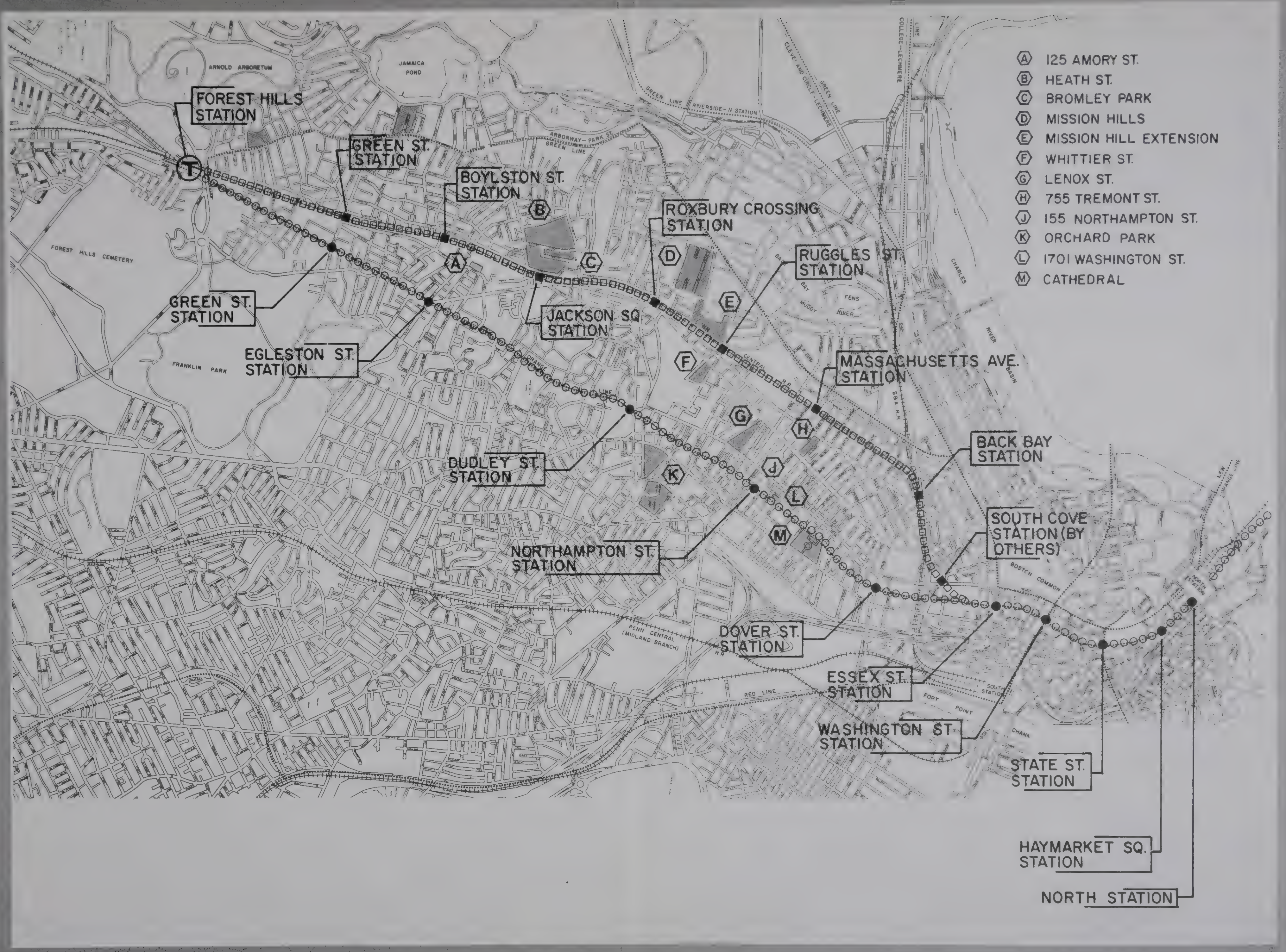
NORTH

SCALE

0 1200 2400 3600

FIGURE V-36

FREDERIC R. HARRIS INC



Economic Impact of the Southwest Corridor on the City of Boston

Development Potential	Residential	Industrial	Commercial/ Retail	Institutional	Open Space/ Recreational	Transportation	Other	Total
Land Area								
Square Feet (000's)	1,675-1,579	862-988	591-624	315-372	903-1,143	7,311-6,881	285-287	11,942-11,865
Acres	38.5-36.1	19.8-22.7	13.6-14.4	7.2-8.5	20.8-26.7	167.8-158.0	6.5-6.6	274.2-273.0
Developed Space								
Square Feet (000's)	1,306-1,211	487-507	250-260	15-70	903-1,143	–	165-287	3,126-3,478
Dwelling Units	1,306-1,211	–	–	–	–	–	–	1,306-1,211
Hotel Rooms	–	–	–	–	–	–	300 Rooms	300
Parking Spaces	–	–	–	–	–	–	351-355	351-355
Investment (000's)								
Total	$52,014-48,190	8,028-8,366	8,965-9,350	1,800-16,800	1,129-1,429	463,305-447,705	7,746-7,749	542,987-539,590
Public	$ 6,784-6,285	730-761	815-850	1,800-16,800	1,129-1,429	463,305-447,705	246-249	474,809-474,080
Private	$45,230-41,905	7,298-7,605	8,150-8,500	–	–	–	7,500-7,500	68,178-65,510
Economic Impact								
Construction Phase								
Jobs[a]	1,803-1,670	278-290	263-271	62-581	39-49	16,037-15,497	268-268	18,750-18,626
Wages (000's)	$23,406-21,685	3,612-3,764	4,033-4,207	810-7,560	508-644	208,487-201,467	3,486-3,487	244,342-244,724
Permanent								
Jobs[b]	–	1,218-1,267	982-1,021	10-60	4	100	44	2,358-2,496
Wages (000's)	$10,448-9,688	12,180-12,670	7,368-7,662	80-580	30	1,300	309	31,715-32,239
Retail Sales (000's)	–	–	$17,500-18,200	–	–	–	–	17,500-18,200
Population	3,181-2,935	–	–	–	–	–	–	3,181-2,935
Tax Revenues Generated (000's)								
City	$2,669-2,473	574-598	642-669	–	–	–	669	4,554-4,409
State	$ 522-484	180-183	1,005-1,045	4-33	1.75	64	16	1,792.75-1,826.75
Development in Area Immediately Adjacent to Corridor[c] (000's)								
Total	N.A.	N.A.	N.A.	$112,120	2,465	N.A.	N.A.	114,585
Public	–	–	–	$112,120	2,465	–	–	114,585
Private	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	–
Development in Larger Area Surrounding Corridor[d] (000's)								
Total	$248,270	563	2,390	549,172	27,742	57,332	53,915	939,384
Public	–	–	–	357,224	27,742	57,332	53,875	496,173
Private	$248,270	563	2,390	191,948	–	–	40	443,211

Note: The range is the result of extension or non extension of the Arterial through Jamaica Plain

[a] Man-years

[b] Permanent positions

[c] Includes projects within one-half mile on either side of Corridor North and South of Forest Hills

[d] Includes following BRA Planning Districts: South End, Washington Park, Model Cities, Jamaica Plain, Hyde Park and Roslindale

[e] Includes the school, fire and police, library, hospital facilities and public building components of the City's ten-year Capital Facilities Program. The two largest program projects are the Campus High School and Boston City Hospital

[f] Includes programmed urban renewal site improvements, infrastructure expenditures, 3-year water and sewer and municipal parking

[g] Includes rail bed to Route 128.

Source: Boston Redevelopment Authority Research Department

FIGURE V–37

(FIG. V-38)

PROPERTIES TO BE ACQUIRED

ALTERNATIVES			PROPOSED ACQUISITIONS							
South Cove to Camden St.		Camden Street to Forest Hills	Private-Commercial		Private-Residential		Public		Vacant	
			Full	Partial	Full	Partial	Full	Partial	Full	Partial
NB-1		NB-1	0	0	0	0	0	0	0	0
--		FH-1	2	4	0	3	3	2	0	0
SC-1	and	FH-1	5	6	3	3	5	4	0	0
SC-2	and	FH-1	3	4	1	3	3	3	0	0
--		FH-2	4	7	0	5	3	2	0	0
SC-1	and	FH-2	7	9	3	5	5	4	0	0
SC-2	and	FH-2	5	7	1	5	3	3	0	0
--		FH-3	2	2	0	0	3	3	0	0
SC-1	and	FH-3	5	4	3	0	5	5	0	0
SC-2	and	FH-3	3	2	1	0	3	4	0	0
--		FH-4	3	5	0	2	3	4	0	0
SC-1	and	FH-4	6	7	3	2	5	6	0	0
SC-2	and	FH-4	4	5	1	2	3	5	0	0
--		FH-5	13	10	15	8	5	4	6	1
SC-1	and	FH-5	16	12	18	8	7	6	6	1
SC-2	and	FH-5	14	10	16	8	5	5	6	1
--		FH-6	10	8	15	8	5	4	6	1
SC-1	and	FH-6	11	8	16	8	5	5	6	1
SC-2	and	FH-6	11	8	16	8	5	5	6	1
PHP-1			13	13	10	8	7	6	6	1
PHP-2			16	15	18	8	7	6	6	1

NOTES TO (FIG. V-38)

Full Acquisition - business or residence to be totally acquired (relocation of residents required)

Partial Acquisition - business or residence to remain

Public - public land owned by City or State

Vacant - vacant lot with or without abandoned building

NB-1 - No-Build - no rail/transit and no arterial street

SC-1 - depressed rail/transit with minimum grade adjustment, South Cove to Cameden Street

SC-2 - depressed rail/transit with Orange Line in tunnel to Dartmouth Street, South Cove to Camden Street

FH-1 - depressed rail/transit, no arterial street

FH-2 - depressed rail/transit, arterial street east

FH-3 - rail/transit on modified embankment, no arterial street

FH-4 - rail/transit on modified embankment, arterial street crossing east to west

FH-5 - modified depressed rail/transit, arterial street east

FH-6 - modified depressed rail/transit, no arterial street south of Jackson Square

PHP-1 - post hearing rail/transit profile, no arterial street south of Jackson Square

PHP-2 - post hearing rail/transit profile, no arterial street east

CHAPTER SIX:
UNAVOIDABLE ADVERSE IMPACTS OF PROJECT ALTERNATIVES AND MEASURES TO REDUCE THEIR IMPACT

6.0 UNAVOIDABLE ADVERSE IMPACTS OF PROJECT ALTERNATIVES AND MEASURES TO REDUCE THEIR IMPACT

6.1 Adverse Transportation Impacts

Transportation impacts which may be adverse can be categorized into two elements: those dealing with surface-street traffic and local circulation for the life of the project,and those dealing with traffic-flow patterns which are temporarily altered during the construction process. The following sections provide a detailed explanation of these two impact categories.

6.1.1 Traffic and Local Circulation

The potential adverse transportation impacts of the project would primarily affect traffic and circulation in the vicinity of the stations. However, most of the stations serve only local traffic or bus-feeder lines. The exception would be Forest Hills, which is located at a major intersection of arterial streets serving the Southwest areas of Hyde Park, Roslindale and West Roxbury. The location of the station at Forest Hills would draw additional bus and auto traffic on Washington Street, Hyde Park Avenue, and Morton Street. It is anticipated that this traffic would be accommodated on a series of street improvements made possible by the removal of the elevated transit lines, and through proposed parking facilities.

Though auto dropoff would be provided at several of the stations, it is anticipated that this would not cause serious congestion on local streets. This is particularly true of the station locations at Green Street and Boylston Street in Jamaica Plain. Auto dropoff facilities at the other stations would be combined with the provisions for bus boarding and unloading adjacent to the stations. In large-volume stations, such as Forest Hills, the auto dropoff and bus loading areas may need to be separated because of anticipated higher volumes of traffic.

On-street parking would also be a problem under all of the station alternatives, as some people would try to park in the vicinity of the stations either to avoid paying the fees at parking lots, or as an alternative as parking areas became full. This increased on-street parking would make the streets less pleasant, hamper traffic flow, and make parking more difficult for local residents. To keep regional transit users from parking on local streets, the communities will need to work with city agencies to enact restrictions and provide enforcement limiting on-street parking to residents only.

Walk-in patronage at the stations would cause more pedestrian traffic in the local areas and more crossing of local streets. While this walk-in patronage would generally reinforce the commercial space in stations nearby, it is recommended that pedestrian- operated crossing signals be installed as part of the pedestrian access facilities, and that access to the rapid transit be provided from both sides of the street where possible. Pedestrian circulation can be a major improvement over the present conflicts at stations on the elevated, such as Northampton, Dudley and Forest Hills.

6.1.2 Traffic Flow

A detailed discussion of traffic flow as it relates to the various alternatives including changes in traffic volume is presented in Section 5.1.6 Arterial Street Impacts.

6.2 Adverse Construction Impacts

6.2.1 Movements of Materials and Equipment

To the extent possible, material and equipment would be moved by rail in order to reduce the impacts associated with street movements. Obviously, once the rail system between Forest Hills and Back Bay is removed, such rail movement will be impossible. However, some material may be ordered early, delivered by rail during demolition-excavation and stockpiled at key points along the route. Other material and equipment would be trucked in on existing arterial streets.

Contracts 2 and 3 of the Depressed Alternative are structured so that each includes the excavation and disposal of approximately 1,500,000 cubic yards. The use of trucks to haul this quantity of material through the Corridor neighborhoods would likely be unacceptable to the community. Railroad hauling appears to be a viable alternative. With the Modified Depressed scheme the amount of material to dispose of off site is reduced to a total of 500,000 cubic yards. The method of removal would be similar to that described below.

The material from Contract 3 could be hauled to the south over the Shore Line with the capability to divert over numerous branches. The material from Contract 2 could be loaded out to the north with unit trains switching onto the Boston and Albany tracks at Back Bay, by way of a temporary cross-over. This train could then be taken out to Beacon Park yard, across the Charles River via the Grand Junction into the Boston and Maine system for haul to a northerly disposal area. Debris from demolished bridges, walls, etc. could be moved in the same way.

Utilizing unit trains of gondola cars and charging hoppers, this system would provide the capability to load-out and haul excavated material to the north, west or south. The contracts are so divided that each contractor may operate freely without interference from the other.

A large quantity of construction material, such as sheet piling, drainage, culverts, track ballast, ties, could be delivered to the job site by rail. Heavy earth-moving equipment and cranes could also arrive by railroad.

6.2.2 Spoil Disposal

6.2.2.1 Statutes and Regulations

There are certain state statutes and local regulation procedures which will apply to the process of disposing of the spoil.[1] These may be briefly described as follows:

a. Should any person, whether a public agency of the Commonwealth or of a city or town, as well as private parties, such as contractors, seek to dispose of the material in a way that will affect areas covered by the Commonwealth's General Laws, Chapter 131, Section 40 (a landmark statute in the United States and known popularly as the "Hatch Act"), a very stringent set of reviews and controls will apply. Under these provisions any person who removes, fills, dredges or otherwise alters any "bank, fresh water, wetland, coastal wetland, beach, dune flat, marsh, meadow or swamp bordering on the ocean or on any estuary, creek, river, stream, pond or lake, or any land under said waters or any land subject to tidal action, coastal storm flowage or flooding" must file a notice of intent to take such action with the appropriate local conservation commission, must present his proposal in a public hearing before the commission, and must follow an order of restrictions that may be applied by the local commission or on appeal by the State Department of Environmental Quality Engineering (the successor agency to the Department of Natural Resources under the reorganization of agencies within the Executive Office of Environmental Affairs). These provisions are key in protecting environmentally sensitive areas throughout the Commonwealth, including but not limited to lands bordering on public water supplies.

The MBTA has indicated to the Department of Environmental Quality Engineering that it will require its contractors to dispose of spoil only at sites approved in ordinance by D.E.Q.E.

---

[1] "Excavated material (dirt, rock, debris) must be disposed of away from the job site.

b. The disposition at the dump site of certain of the spoil material will be covered by regulation of the local board of health pursuant to the General Laws, Chapter 111, Section 150A. Under that law, any person, public or private, including municipalities, must obtain a board of health permit to locate, establish and operate a "refuse" disposal facility, and must operate such facilities in accordance with health regulations. For the purpose of these regulations, "refuse" is defined as "all solid or liquid-waste materials, including garbage and rubbish, but not including sewage." Further, regulations issued by the Department of Public Health under this statute with respect to sanitary land fills, define "solid waste" as any "unwanted or discarded solid material". In short, all of the spoil material that is unwanted or discarded as non-reusable material is covered as "refuse" under this statute. This would include the clay and fill materials that are not transported to sites for reuses, as well as the silt that is not to be reused.

Moreover, in cases where disposal at a sanitary landfill is contemplated, there are strict regulations concerning the establishment and use of those sites. In addition, to provisions for site selection and preparation, the regulations provide operating requirements including cover materials that will not attract rodents, flies, or other pests, which will not erode, and which will provide a seal and cover sufficient to support vegetation. The regulations also require fire protection and prevention procedures and adequate access controls. A key element of the regulation is the requirement that the operator of the landfill site provide a layer of at least six inches of compacted cover at the end of each day's operations.

Finally, the Department of Environmental Quality Engineering is required under Section 150A to approve the proposed uses as well as the plans and designs for refuse disposal facilities. It has always been the policy of the Department to require that refuse disposal sites, including sites for the disposal of materials such as the embankment spoils, meet the requirements for sanitary landfill.

c. The disposition of all of the spoil material, whether treated as "refuse" under the above regulatory system, or as material for resale or other reuse, is covered by local zoning codes promulgated under authority of General Laws, Chapter 40A. Under this statute, cities and towns may regulate the location and establishment of a public or private dump. This power and the validity of zoning ordinances prohibiting the use of land for public or private dump sites without the approval of certain city or town authorities (e.g., board of aldermen, building commissioner, board of appeals, as well as the board of health) have been upheld in the Commonwealth.

d. In cases where a person collects and transports "offensive" substances, he must obtain a permit from local boards of health pursuant to General Laws, Chapter 111, Section 31A and 31B or, in cases where he transports but does not collect such substances, he must follow health regulations issued for that purpose. In light of the intent of this statute, which is to protect the public health, and in light of the mandate of the Massachusetts Environmental Policy Act, General Laws, Chapter 30, Section 61, that "unless a clear contrary intent is manifested, all statutes shall be interpreted and administered so as to minimize and prevent damage to the environment", it is likely that the term "offensive substances" in Section 31A would be interpreted broadly. If spoil material removed from the project falls within the limits of "offensive substances", the contractor carrying such substances would be obligated to follow regulations issued under Sections 31A and 31B. In any event, the MBTA could provide in its contract specifications that the transport and disposition of such substances as part of the project spoils should follow such regulations as may apply under this statute.

e. It is not anticipated that any of the spoils materials will involve polluted or hazardous substances. However, should any of the removed materials be found to be "hazardous" substances or wastes within the meaning of General Laws, Chapter 21, Sections 57 and 58, their removal and disposition will be controlled under a highly stringent set of regulations issued by the Hazardous Waste Disposal Board (within the Department of Environmental Quality Engineering, Executive Office of Environmental Affairs).

The regulations define the substances that are covered, specify the means of disposal, including a process for the careful selection of disposal sites, and set license and inspection fees. The key provisions are those which, following the statutory standard, define hazardous wastes as "substances which, because of their chemical, radioactive, flammable, explosive or other characteristics, constitute or may reasonably be expected to constitute a danger to the public health, safety or welfare or to the environment." Special restrictions in the regulations apply to the disposal of hazardous substances in any waters of the Commonwealth. Moreover, the regulations provide that the Division of Water Pollution Control must issue a license to any person handling or disposing of hazardous wastes, and must also approve the land site at which certain of the wastes are to be disposed. Disposal sites must, at a minimum, meet the requirements of the Sanitary Landfill regulations, which are discussed above.

f. In regard to the enabling act for the MBTA, General Laws, Chapter 161A, Section 3(i), the Authority may in fact be exempt from the local health or zoning regulations or by-laws described in paragraphs "b" and "c" above. The relevant statutory language provides that "except as otherwise provided in this chapter, the directors of the Authority shall determine the character and extent of the services and facilities to be furnished, and in these respects their authority shall be exclusive and shall not be subject to the approval, control or direction of any state, municipal or other department, board or commission".

However, assuming that this exemption applies to the Authority, the exemption is <u>not</u> interpreted to run to the Authority's private contractors. In recognition of this, contracts between the MBTA and their construction contractors require that the contractor obtain all necessary local licenses and permits and that they otherwise comply with local by-laws.

The Authority does not interpret Section 3(i) of its statute as exempting it from provisions of state law authorizing regulation by the state in the interest of protecting the public health or the environment e.g., the "Hatch Act" or the Massachusetts Environmental Policy Act, General Laws, Chapter 30, Sections 61 and 62.

6.2.2.2 Spoil Disposal

The earthmoving schedule as described in Section 5 allows that spoil could be hauled off the job site by rail to both the north and south. The MBTA has committed itself to disposal at sites approved by the Department of Environmental Quality Engineering. This method of controlling disposal would insure the environmental protection of any area in which such disposal were contemplated.

The preliminary engineering estimate indicates an excavation of 2.3 million cubic yards of material from the existing railroad embankment and from the proposed depressed cross-section in the Post Hearing Alternative. Of this amount, 0.3 million cubic yards would be reused on site, either as fill under the roadway, to dress the slopes, or as fill material. The surplus excavated material of 2.0 million cubic yards would be hauled to reuse sites. Transporting can be accomodated by rail to the north and to the south as described in the section on Construction Sequencing. (See Section 5.2.5.2)

Based on field observations, and the boring data that is available, it is anticipated that the existing railroad embankment consists primarily of granular materials and possibly some cinders. The quantity of crushed stone ballast to be removed is so small as to be insignificant. The remainder of the embankment will consist of granite blocks which form its retaining walls.

Existing available boring information indicates that the excavation below the railroad embankment will consist of gravels, sands, silts, clays, and ledge. Generally, where the excavation follows the alignment of the original Stony Brook Culvert, the material will consist of man-placed fills of sand and gravels. In virgin areas, silts and clays will be encountered, though to a rather small degree. The predominant materials will probably be permeable sands, gravels and silts. Ledge excavation is expected to represent a rather small portion of the toal excavation and will be encountered primarily at the lowest elevations of the cut, and then only in isolated locations.

The spoil material which consists of sands and gravels is in particular demand for structural or engineered fills and embankments. A portion of this material would be used to raise the grade of land adjacent to the Corridor as described in the project description for both open space and development sites. Off-site applications of this material could be in building foundations, highways, airports and in filling of quarries. Sands and gravels could also be used in covering sanitary landfill operations, even though this may not be the most productive use of such materials.

Silts and clays could be utilized in the making of non-structural fills for parks, playing fields and the like. Silts and clays would also readily lend themselves to utilization in sanitary land-fill operations. In this connection, the clays would be most desirable for use in forming the final impervious topping later or blanket over a sanitary fill operation. As is indicated in Appendix G, there are many such sites within the Commonwealth.

Blasted ledge, if sufficiently broken up, can be readily incorporated into a structural or engineered fill. Such a use would also apply to the granite contained in the present retaining walls. There are also architectural applications to which the dressed granite from the retaining walls might be put.

The possibility of dumping spoils at sea has been raised. It is very unlikely that this would be acceptable as an alternative as dumping sites close to shore are at a premium for disposal of spoil from dredging operations. Sites off the edge of the Continental Shelf are too remote for existing hauling barge and tug equipment.

6.2.3 Interruption of Utilities

Utility relocations would be so designed and their construction so scheduled that it will be possible to maintain services during construction. For example, the Stony Brook Conduit crossings would be relocated away from their existing conduit to function during relocation work. Other major utilities would be hung on adequate supports until placed in their final location.

6.2.4 Traffic Flow

Local traffic disruption is likely to occur during the construction of any of the alternatives. This is unavoidable with projects of the size suggested in the Southwest Corridor. Disruptions that are most likely to occur are associated with utility relocation, bridge structures, and reconstruction of existing str streets. A detailed description of traffic flow during construction for each alternative is presented in Section 5.2.5.4,Traffic Flows. Either temporary bypass roadways would be used where local conditions would permit or appropriate detours would be established to guide motorists to adjacent bridges.

Utility-relocation work is generally localized in the area of major structures. To minimize the disruptive effect of such work, efforts would be made to coordinate the various utility companies at the time final construction plans became available. The contractors doing the relocation work would be expected to schedule their work to assure that all necessary materials were on hand prior to making street openings. Where necessary, utility trenches would be covered with street plates, particularly during morning and afternoon peak hours, to minimize the disruptive traffic impact.

6.2.5 Pedestrian Movements

The construction impacts on pedestrian movements are discussed in Section 5.2.5.5 , Pedestrian Movements for each of the alternatives. These adverse impacts would be of minimal nature because temporary pedestrian crossings would be used where possible and the construction-time interval would be made as short as possible.

6.2.6 Noise During Construction

The noise emitted by construction operations is regulated by a number of Federal, State and local laws. The Federal Highway Administration requires that construction noise be considered in the Environmental Assessment stage of the project. Details of the impact of construction noise are discussed in Section 5.2.5.6 , Construction Noise.

6.2.7 Air Quality Controls During Construction

State air pollution-control regulations provide a basis for requiring emission controls of fugitive dust from construction activities. The applicable regulations are listed below:

Regulation 1: No person owning, leasing or controlling the operation of any air contamination source shall willfully, negligently, or through failure to provide necessary equipment or to take necessary precautions, permit any emission from said air contamination source or sources of such quantities of air contaminants which will cause, by themselves or in conjunction with other air contaminants, a condition of air pollution.

Regulation 9.3: No person shall cause, suffer, allow, or permit a building, road, driveway, or open area to be constructed, used, repaired, or demolished without applying such reasonable measures as may be necessary to prevent particulate matter from becomming airborne that may cause or contribute to a condition of air pollution.

The adverse effects of construction activities on air quality will be minimized using all reasonable controls. Excavated material, where possible, would be hauled out principally by rail, not truck, using covered gondola cars for all material capable of releasing fugitive dust emissions. In addition, appropriate chemicals will be used to cover dust-producing operations during construction.

The air quality impacts associated with heavy-duty construction equipment used in excavation and landfill activities can be indicated best by examining the average emissions of a diesel-powered wheeled bulldozer used in contruction. Emission factors for this type of equipment have been developed by EPA* and are given in terms of grams of pollutant per hour of operation. These emission factors are compared in Fig. VI-1 with corresponding factors for an average motor vehicle in the Southwest Corridor (in 1975) traveling at 20 mph. The results indicate that one bulldozer emits less carbon monoxide and hydrocarbons, but more nitrogen oxides, sulfur oxides, and particulates than one motor vehicle. Fig. VI-1

*Compilation of Air Pollutant Emission Factors, U.S. Environmental Protection Agency, Publication No. AP-42, Second Edition, (including Supplements 1-5). Research Triangle Park, North Carolina, 1975.

also presents a ratio of the emission factors giving the equivalent number of motor vehicles for the emissions of each pollutant from one bulldozer. These results indicate that even if a large number of heavy-duty construction machines are operated simultaneously in the Southwest Corridor, their total emissions would be insignificant compared to that generated by the large volume of motor vehicles that travel in the Southwest Corridor daily.

6.2.8 Commercial Disruption, Amelioration

The retail area on Hyde Park Avenue at Forest Hills should have short-term parking areas for customers and construction-worker parking would be provided elsewhere. Traffic flow should be maintained on Hyde Park Avenue. The temporary Orange Line station would be constructed to maintain as much retail patronage as possible.

Traffic flow on Washington Street should be maintained if at all possible. Similarly, Arborway trolley service should be maintained and should terminate as close to the Orange Line station as possible.

Street access should be maintained in the Boylston Street and Green Street area. Airborne noise and dust can be controlled somewhat; however, some of it is unavoidable. Scheduling of certain work in late fall through early spring may help mitigate some impact which would be most objectionable when windows are open.

If the arterial street is to be built, sections could be in operation before certain planned street closings occur. This would help to maintain access and minimize loss of patronage. Access for fire and emergency vehicles is also a consideration here.

Removal of the Washington Street Elevated should be accomplished expeditiously. Vehicular access to all properties should be maintained even if on a restricted basis. Certain truck-dependent activities such as warehousing, food and liquor stores, should be contacted and given maps of recommended access routes which they, in turn, would give out to the truckers. This would help control extra truck traffic on neighborhood streets. Between Forest Hills Station and McBride Street, there would be no good alternate to Washington Street during the removal of the elevated structure. If the arterial is not built, a temporary road between Forest Hills and Call Street on the west side of the tracks may be considered.

6.2.9 Rail Service Loss and Replacement During Construction

The Construction of the proposed project represents a major undertaking. Regardless of alternative, the construction along the Shore Line (main line of the Penn Central Railroad) would involve major project elements adjacent to, over and below the existing right-of- way.

This massive transportation improvement project could be carried out while railroad services were maintained for the current commuter riders. It is estimated that maintaining the commuter rail service during construction would cost an additional \$69.7 million dollars (including 30% engineering and contingencies and an estimated 15 months of additional time.

In addition to the construction time and cost implications, patron inconvenience and delay would be necessitated by slower train operations due to construction operations and the close proximity of construction equipment. Under these conditions, an estimated 5650 rail riders would be inconvenienced over a 5 to 6 year period.

It is therefore proposed that service be temporarily replaced on other mass transportation rights-of-way and modes during the 4 year construction period.

6.2.9.1 Proposed Services During Construction

It is proposed that service from Stoughton, Providence and Franklin be diverted at Readville to the Midland Division traveling then directly to South Station.

In addition, a train shuttle between South Station and Back Bay is proposed as described in Section 6.2.9.2.A. It is proposed that Needham Branch to South Station passengers be offered substitute express bus service in new coaches. These measures would permit the estimated 3000 riders whose destination is South Station, a direct ride in the same or shorter travel time.

It is further proposed that Needham Branch riders bound for Back Bay from Needham, West Roxbury and Roslindale be offered express bus service to Copley Square. Estimated travel times for the bus routings are defined in Sections 6.2.9.2 and 6.2.9.3.

Riders from West Roxbury and Roslindale bound for the downtown shopping and financial districts could ride the existing bus and rapid transit system to downtown, or charter bus subscription service might be offered (see Section 6.2.9.5).

Riders utilizing Mt. Hope (about 5 to 10 patrons) and Hyde Park/Cleary Square (about 90 to 115 patrons) stations would not be served during the construction period (see Section 6.2.9.4).

The projected ridership on each commuter branch as well as proposed substitute service during construction is presented below.

PROJECTED RIDERSHIP FOR SUBSTITUTE TRANSPORTATION
SERVICE DURING SHORE LINE RECONSTRUCTION

Destination	Service Origin	Stoughton[1] Providence Franklin	Needham[2]	West Roxbury[3] Roslindale
Back Bay	1770	1100	320	350
South Station	3880	3000	480	400
Total Riders	5650	4100	1550	

[1]See Section 6.2.9.1 and 6.2.9.4
[2]See Section 6.2.9.2
[3]See Section 6.2.9.2

6.2.9.2 South Station/Back Bay Shuttle

If rail service were to be diverted to the Midland Division as proposed during construction, alternative methods of transportation would be provided for commuter railroad riders bound for Back Bay Station. Approximately 1100 riders bound for Back Bay use the Stoughton, Providence and Branklin Branch which services all stations in the towns of Stoughton, Canton, Attleboro, Mansfield, Foxboro, Sharon, Norwood, Readville, Walpole, and Norfolk.

Patrons arriving at South Station via the Midland Division would be shuttled to Back Bay. Riders bound for South Station would suffer no delay over current service during diversion to the Midland Division. Provisions for riders on the Needham Branch are discussed in Section 6.2.9.2.

Three alternatives are described below and are discussed in depth in the Appendix D.

A. <u>Shuttle Train Service</u> (The Proposed Service) Riders leaving Franklin, Stoughton and Providence commuter trains would walk across a platform, board a waiting Budd-car shuttle and alight at a temporary rail stop in the Back Bay area near the existing station. The shuttle would return to South Station with persons wishing to use the rail services at South Station.

Rail shuttles would meet every Franklin, Stoughton, and Providence train arriving in the AM peak period. Riders wishing to go to Back Bay would not have to wait very long for a shuttle. The rail shuttles could be scheduled to leave for Back Bay as soon as riders transferred from their train to the shuttle. There are two exceptions to this statement and they occur during the AM peak period. Two of the shuttles respectively meet two arriving trains. Riders wishing to go to Back Bay from the first train must wait five minutes for the shuttle's departure in each instance.

During the PM peak period, shuttle trains are scheduled to meet all but two of the Franklin, Stoughton, and Providence trains leaving South Station. In these two instances, riders using the shuttle service must wait at South Station six minutes for one train and ten minutes for another train. During the mid-day period, the majority of the arriving and departing commuter trains would be met by rail shuttles.

Trains scheduled before 7 AM or after 7 PM would not be met by rail shuttles in this alternative. Weekend trains would not be met. Demand for shuttle service at these times does not seem to justify the cost of providing shuttle service by rail. It is estimated that 1100 commuter rail patrons would be inconvenienced by ten minutes (in each direction) by the project if they used the service.

AMTRAK trains would not be served by rail shuttles in this alternative. Back Bay is a final destination for a small share of inter-regional and interstate rail users. The 250 users arriving by AMTRAK from the southwest could make transit connections to Back Bay via taxi or Red and Green Line transit.

The inconvenience would last for most of the four- to five-year duration of the Orange Line relocation.

Commuter rail and AMTRAK service via the Boston and Albany Railroad to Back Bay and South Station would be maintained during construction with minor delays (if any) at Back Bay during construction for the current four trains in each direction per day.

B. <u>Bus Service Via the Massachusetts Turnpike</u> Bus service could be offered if a ramp were constructed to allow westbound buses on the Turnpike to return eastbound to South Station. The ramp would be located near Exeter Street and Huntinton Avenue. The grade of the ramp would be undesirable because of constraints.

<u>C. Bus Service Via Local Streets</u> Alternative C differs from Alternative B in two respects. First, to serve Back Bay and South Station, buses operated in Alternative C use local streets instead of the Massachusetts Turnpike. Second, the service in Alternative C can include stops at locations along the bus route in addition to serving the immediate vicinity of Back Bay Station. No intermediate locations can be served in Alternate B.

Buses leaving South Station in Alternative C proceed to Back Bay via Atlantic Avenue, Kneeland, Stuart, Eliot, and Providence Streets, St. James Avenue, Clarendon, Buckingham and Dartmouth Streets. The buses will return to South Station via Dartmouth, Stuart and Kneeland Streets and Atlantic Avenue. (See Appendix D for details of schedule.)

<u>Travel Times</u>

Fig. VI-2 compares the travel times associated with the three alternatives. Travel times associated with Alternatives A and B are the same.

From the standpoint of travel time between South Station and Back Bay, both alternatives are favorable to Alternative C.

Reliability and Convenience

Fig. VI-3 presents a ranking of alternatives from several standpoints of reliability and convenience.

The first category is arrival on schedule. Alternative A operates on a rail right-of-way between two stations which now contain six tracks. This Alternative provides for a maximum of two shuttle trains operating simultaneously. This is easily accomplished since most of the commuter rail service will be rerouted from the right-of-way. The travel times in Alternative A will not vary significantly. Of the services offered in the Alternatives, rail service will have the best record for on-schedule arrivals. Bus service offered in Alternative C involves operation of buses entirely on local streets. Traffic congestion, construction and parking violations are likely to contribute wide variations in travel time between South Station and Back Bay under Alternative C. Of the services offered, bus service in Alternative C will have the poorest record for on schedule arrivals.

The second category is length of walk at South Station necessary to transfer between the commuter trains and shuttle vehicles. Rail shuttle service is ranked superior to services involving buses. Riders of rerouted commuter trains could often transfer across a platform to reach shuttle trains. These riders must walk further to reach the buses.

The third category is length of waiting time necessary to transfer between vehicles at South Station. During the peak hours, several shuttle buses meet each train. Only one shuttle train meets each train. Buses have a greater potential than trains for leaving and departing quickly. Alternatives involving buses are ranked as superior to rail-shuttle service.

The final category is the convenience of location on pick-up and drop-off points within Back Bay. Bus service on local streets has the potential for serving several locations along the route without affecting service. These locations served by Alternative C are closest to major employment sites, commercial sites and transfer points of all Back Bay locations served by the Alternative. The Back Bay location served in Alternative B is more convenient than the location served in Alternative A for most riders, but this is the case today at the existing Back Bay Station. The location served in Alternative B is closer than Back Bay Station to employment, shopping and MBTA transfer sites.

The comparison of Alternatives in Fig. VI-3 does not show any of the Alternatives as equal to or more favorable than the others in all four categories listed. Some of the categories are more important to riders or operators, who must schedule vehicles and assign drivers shifts. It is also of importance to riders who must meet trains that are scheduled to leave South Station or who must arrive at work at a fixed time. Alternative E while it has potential for serving the most convenient locations in Back Bay, offers the service that has the widest variations in travel time.

Costs

The total of the operating and capital expenses of the alternatives are given in Fig. VI-4.

6.2.9.3 Express Bus Service Needham to Boston

Express Service between Birds Hill, Needham Center, and Needham Heights and Boston. (The Proposed Service)

If Needham Branch rail service were discontinued during construction, the approximately 800-900 commuter rail riders using stations in Boston

could either use the frequent, existing feeder bus service to the existing Orange Line during construction or alternative service as described in Section 6.2.8.3. No direct alternative public transportation service currently exists for the approximately 800-900 commuter rail riders using Needham stations. The express bus service option was developed as an alternative service since it was comparable to commuter rail service to Needham and could be used as a substitute service during the construction phase of the relocated Orange Line.

The bus service option offers express bus service via the Massachusetts Turnpike between Needham and Boston. All bus service in this package would operate in one direction only on a loop serving one stop each at Needham Heights, Needham Center, and Birds Hill station vicinities. Buses would operate on the loop via Highland Avenue, Great Plain Avenue, and Route 128. Buses from Boston would enter Highland Avenue from Route 128, turn on Great Plain Avenue, and return to Route 128 at the Great Plain Avenue access ramp. Having served the loop, buses would then proceed to Boston via the Massachusetts Turnpike.

During the morning and evening peak hours, two Boston locations, Copley Square and South Station, would be served separately by express buses to and from Needham. Service frequencies between Needham and South Station would be greater than frequencies between Needham and Copley Square.

During the remainder of the day, two Boston locations would be served by the same express buses to and from Needham. A bus from Needham would proceed first to Copley and, then, to South Station. The bus would return to Needham serving, first, South Station, then, Copley Square, and go on to Needham via the Massachusetts Turnpike.

Service Frequency and Capacity

Any express bus service designed to be comparable to Needham's rail service must offer higher frequencies to the major downtown destination, because the capacity of a train serving the Needham Branch greatly exceeds the capacity of an express bus. Fig. VI-5 compares service frequencies (in terms of inbound departures), seated capacities, demand for the two alternatives and for currently offered rail service. Copley and South Station are served separately in the peak period and are on the same route during the remainder of the day. Daily departures and capacities shown for express bus alternatives are to either Copley or South Station. Thirty buses leave Needham daily. South Station is served by 27 of these buses, and Copley is served by 9 of these buses.

Both destinations are served by each departure by rail. Seated capacity for rail during the peak hour greatly exceeds Needham demand. The additional capacity for rail is necessary to accommodate riders boarding at stations outside of Needham. The alternative has the capacity to serve estimated demand. It offers more frequent service than current rail service in order to provide line capacity equal to the line capacity offered by rail.

Travel Times

Fig. VI-6 compares travel times of the alternative with current rail service to Needham. Fig. VI-7 presents this data in the form of a mock schedule. With a few exceptions, scheduled travel times by rail are similar to travel times estimated for the two alternatives.

Fares

At the present time, rail fares to Needham are as follows:

Between South Station (or Copley) and:	One Way Fare
Birds Hill	$1.20
Needham Junction	1.25
Needham Center	1.30
Needham Heights	1.35

It is consistent with the MBTA Fare Review Task Force recommendations for changes in express fares for 1976 to assume that an express-bus service to Needham would have a minimum of $1.00 and possibly $1.25 one way fare.

At this time, changes in the fare structure are being studied by the MBTA. These changes are being made to achieve greater consistency between fares charged and transit service provided throughout the MBTA District. It is impossible to predict what discounts would be available to commuters using express bus or what commuter-rail fare structure will be in effect at the time assumed for implementation of express bus alternative.

Costs

Cost comparisons for all bus alternatives are tabulated in Section 6.2.9.5.

6.2.9.4 Bus Service Boston to Roslindale/West Roxbury

Three transit service alternatives are presented for the approximately 500 using Roslindale, Bellevue, Highland and West Roxbury Stations if the Needham Branch service were suspended during construction. The approximately 100 riders boarding commuter rail trains at Forest Hills could, instead, use the Orange Line which can be located at its station immediately adjacent. Because of the high frequency of service offered to the Orange Line's current 36,000 riders, no additional services on the Orange Line are necessary under Alternative A below.

Alternative A: Provide additional capacity on the feeder bus route to Forest Hills Station. It is estimated that the operation of eleven additional buses in the morning and evening rush hours would provide enough extra seating capacity to accomodate the approximately 800 Boston users of the Needham Branch stations. This modest increase in the number of vehicles is the result of the high frequency of bus service already provided to the existing 2700 to 3000 peak-hour bus riders from West Roxbury and Roslindale.

Travel times to downtown Boston (South Station) by the Needham Branch and by feeder bus to the Orange Line are compared in Fig. VI-8. Waiting time at the Forest Hills Station was estimated to be two minutes for the purpose of calculating the travel times.

More travel time is necessary to reach Boston via feeder bus than via commuter rail from the four station area A loss in transit use would typically be expected as a result of this increase in travel time. The loss is offset by an increase in the use of Route 37 due to improved service frequencies. Trains on the Needham Branch have a maximum of a 20-minute frequency during the peak hour. Buses on the Route 37 would have four-minute frequencies during the peak hour.

Alternative B: Provide express bus service to Back Bay and additional capacity on the feeder bus route to Forest Hills Station.

Under this Alternative, an express bus service from the West Roxbury/ Roslindale area to Copley Square would be operated during the morning and evening peak periods. Travel times to Back Bay would be longer on the express bus than they are currently on the Needham Branch. It takes 21 minutes to reach Back Bay Station from Highland Station via rail. Express bus travel times would probably be between 36 and 43 minutes.

In addition to the express bus service, Alternative B provides for extra buses to serve Route 37 during the morning and evening peak hours. It is estimated that six round trips in each peak hour could accommodate the Needham Branch riders not wishing to go to Back Bay.

Alternative C: Provide express minibus service to Back Bay and additional capacity on the feeder bus route to Forest Hills Station.

Alternative C is similar to Alternative B. Both options offer express service and additional feeder service. The express service in Alternative C is distinguished from the service in Alternative B by three characteristics. First, minibuses would be used in Alternative C. Regular 46-seat buses would be used in Alternative B. Second, frequency for Alternative C would be greater than the frequency offered in Alternative B. The minibus has less capacity than a standard bus. Higher frequencies are necessary to serve the express bus route with minibuses. Third, the express bus route is essentially the same in both options. The minibus has a lower turning radius than the standard bus. This permits the minibus to use Pond Street and the Jamaicaway around Jamaica Pond instead of Parkman Drive and Perkins.

Under Alternative C, hours of operation and travel times are the same as in Alternative B. During the morning peak period, there are 13 departures to Boston under Alternative C. During the morning peak hour, nine of these departures are made. Similar service is offered during the evening peak period.

In addition to the express-bus service, Alternative C provides for extra buses to serve Route 37 during the morning and evening peak hours. It is estimated that six round trips in each peak hour could accommodate the Needham Branch riders not wishing to go to Back Bay.

Alternative D: It would be possible to provide charter or subscription bus service from specified locations in West Roxbury and Roslindale to specified locations in Boston. This service would be pre-paid and run on a fixed route to downtown. Such service could be coordinated with or by key employers. While this is desirable, it is impossible to predict demand for this service at this early date.

6.2.9.5 Bus Service, Mount Hope and Cleary Square to Boston

A small number of riders at Cleary Square (90 to 115) and Mount Hope (5 to 10) now use these stations in going to downtown Boston. It is not practical to consider special transportation packages for these riders since existing bus service to the Orange Line at Forest Hills from both locations and the close proximity of Cleary Square to Readville would result in adequate substitute transportation at no additional cost to the rider or the MBTA.

6.2.9.6 Comparison of Operating Expenses During Construction For Needham Branch Riders

Three different modes were considered for service to Needham Branch riders during construction:

a. Needham express bus and feeder bus to Forest Hills

b. Needham express bus; feeder bus to Forest Hills; and West Roxbury/Roslindale express bus

c. Needham express bus; feeder bus to Forest Hills; and West Roxbury/Roslindale express minibus

Figures VI-9, 10, and 11 show the comparison of annual expenses and revenues for each of those modes.

6.2.9.7 Effect of the Proposed Services During Construction Upon Railroad Patronage

Patronage is a function of travel time. As is noted above, travel time for South Station-bound passengers would be the same as it is today. The chart below further enumerates this time and indicates that certain South Station-bound passengers who use the Midland Division can actually benefit through the saving of 6.8 minutes of travel time. The chart also shows the derivation of the average 10-minute increase in travel time for passengers who arrive at Back Bay via rail shuttle.

Travel Time To South Station
Via Upgraded Midland
(Assumes Upgrading to allow
80 mile per hour speeds as
provided in Capital Grant Application)

	Time	Cumulative Time	Distance	Cumulative Distance
Accelerate from Rt 128	2:12	2:12	1.20	1.20
Run at 65 mph	:12	2:24	.21	1.41
Slow to 15 mph	:50	3:14	.56	1.97
Cross to Midland @ 15 mph	:48	4:02	.20	2.17
Accelerate to 80 mph	3:12	7:14	2.29	4.46
Run at 80 mph	3:35	10:49	4.78	9.24
Decelerate to 15 mph	1:05	11:54	.86	10.10
Run at 15 mph to South Sta.	4:24	16:18	1.10	11.20
Total	16:18		11.20	

Time to Back Bay From Route 128

Via Main Line: Scheduled at 14 to 23 minutes

Via Upgraded Midland:	Rt. 128 to South Station:	16.2 minutes
	Wait at South Station:	4.0 minutes
	Shuttle to Back Bay:	5.5 minutes
	Total Time Approximately:	26.0 minutes

Additional Time To Arrive At Back Bay
Via Upgraded Midland: Approximately 6 to 12 minutes

6.2.9.8 Restoration of Back Bay Station

As part of the proposed project, a new Back Bay Station will be constructed. This station is to be available to railroad commuter patrons and all trains scheduled for the shore line are expected to make this stop. The investment in high platforms will afford better service with full facilities for the handicapped. It will also provide direct connection between AMTRAK, Commuter Rail and the Orange Line giving commuters convenient access to downtown distribution by the Orange Line subway, a benefit which they do not have today. AMTRAK will also utilize the Back Bay Station as part of its high-speed service between Boston, New York and Washington.

6.3 Adverse Air Quality Impacts

All of the adverse air quality impacts of the project alternatives discussed in Section 5 are unavoidable for the traffic data base and street geometry analyzed. A reduction in the impacts will occur with time as emission controls are exercised.

Typical emissions from an idling diesel engine in a bus are 0.64 grams per minute of carbon monoxide, 0.32 grams per minute of hydrocarbons, and 1.03 grams per minute of nitrogen-oxide. These can be compared to similar emission rates from a light duty vehicle of 13.0, 0.63 and 1.11 grams per minute respectively. In all cases, the rate of emissions for a bus are exceeded by those of an automobile. The exhaust of a diesel engine also creates a noticeable and unpleasant odor in the air.

Thus, the operation of an offline bus station at which the dwell time of vehicles is greater than that needed only to load or unload passengers will result in a localized air pollution problem only if a large number of buses are idling simultaneously. The impact of such a station can be minimized by observance of Massachusetts Air Pollution Control Regulations 11.1.2 which prohibits unnecessary idling of such vehicles for more than 5 minutes.

For this project, stationary source of air pollution impacts are projected to be insignificant compared with the total fuel used in the area.

6.4 Adverse Water Resources Impacts

6.4.1 Flooding

Flooding within the general project area is unlikely because of the existing extensive storm drainage network in the Corridor.

Construction of the Embankment alternative would have little impact because the existing network would require only minor modification. Replacement facilities would provide for present or enlarged capacities to handle runoff. Flooding which presently occurs at local cross streets would be eliminated by improved cross street profiles.

The Depressed alternatives would have closed drainage systems with gravity flow lines to three pumping stations The pumping stations would be designed to cope with a 100 year storm and would be located close to existing drains such as Stony Brook Conduit which would be capable of handling the discharge.

Pump stations would likely be of the triple wet wall type - two main pumps and one reserve pump. Timing devices would alternate the operation of the pumps to maintain even wear. Two sources of commercial power would be provided for pump operation. In addition, a standby diesel-electric generator would be provided at each pumping station to insure positive pumping capability during a possible commercial power outage.

6.4.2 Siltation and Chemical Pollution

Techniques used during construction to minimize soil erosion and to prevent silt and other pollutants from entering local water courses include the following:

- Exposed erodible area is kept to a minimum. Only the area needed for immediate grading is cleared or scarified.
- Wood chip mulch on 2:1 slopes
- Adequate sedimentation basins are built prior to grading. All grading runoff is then channeled to enter these basins.

- Sedimentation basins would also be constructed to receive ground water that would be pumped during construction and dewatering operations. Suspended solids would be allowed to drop from suspension before such fluids were disposed of.

- Rechanging of ground water would take place in accordance with State and City regulations.

- No discharge of pollutants (sanitary waste, crankcase oil, solvents, lubricants, etc.) into streams is allowed during or after construction.

However, it is possible that approximately 3 to 6 tons per acre per year of sediment will enter Stony Brook Conduit and other nearby drainage facilities. This amount is acceptable and it is comparable to prevailing erosion rates.

Chemical and petroleum products used in the construction will cause some temporary pollution. Again, by implementing proper controlling measures, such pollution will be kept within acceptable limits.

6.5 Noise Abatement Considerations and Techniques

This section describes noise abatement considerations and techniques to minimize impact.

Existing noise levels are described in Section 2.3.2.

Projected noise levels and impacts for all proposed alternatives are described in Section 5.2.

Measures to reduce noise impacts are included in the preferred alternative.

1. The following measures to reduce the level of noise and vibration impact will be employed for the full length of the project:

   a. Track shall be welded into approximately 1500-foot lengths.

   b. Vibration isolators will be installed.

   c. Ties will be set in ballast.

   d. The depressed alignment will be contained by retaining walls, typically 19 to 20 feet high, which will shadow train operations including the Northeast Corridor Rail Project's overhead catenary electrification.

2. In addition, decks and barrier walls will be employed in specific locations for acoustic purposes.

   a. Berkeley Street to Clarendon Street - the platform canopies will be designed to reduce the noise from transit and railroad operations as well as the Massachusetts Turnpike upon residences to the south.

   b. Dartmouth Street to Massachusetts Avenue Station - a continuous deck will be provided across full height walls in this densely populated area where row houses directly abut the tracks.

c. Ruggles to Prentiss Streets and Heath to Centre Streets - a deck, which will also be used for recreational purposes, will be provided in these locations adjacent to public housing projects where tall apartment buildings (8 to 10 stories) would otherwise be severely impacted because of their direct line of sight to the rails. At the Heath to Centre Street location, it is expected that this deck would be part of the Jackson Square Transit Construction.

d. Minton Street/Lorene Road to Cornwall Street/Oakdale Street and Williams to McBride Streets - an acoustic and recreational deck is included in these locations primarily for purposes of reinforcing major community pedestrian patterns now served only poorly by the underpasses through the embankment. They are located between major residential areas and the public facilities which serve them, including the new Southwest II High School, Our Lady of Lourdes School and the Jamaica Plain Neighborhood House. The decks would provide a benefit in noise reduction to the adjacent residential areas.

e. Station area decks - each station area will be constructed so as to include decking over both the transit and railroad immediately adjacent to the headhouse so as to minimize the noise impact of train operations upon the immediate environment and to encourage pedestrian movement and local commercial development.

f. Barrier walls within the right-of-way - barrier walls will be provided between the transit and railroad tracks at stations to minimize the impact of fast-moving railroad trains as they pass patrons waiting on the transit platform. A continuous barrier wall will also be constructed between Berkeley Street and Dartmouth Street to shield transit and railroad patrons from the continuous noise of vehicles on the Massachusetts Turnpike.

The noise levels indicated in Figures IV-49 to IV-60 and IV-63 to IV-65 for Alternatives PHP-1 and PHP-2 are those anticipated in the proposed Project. The noise levels shown are the maximum levels anticipated, and noise attenuation techniques will be adopted as necessary to maintain noise levels within this limit.

6.5.1 Berkeley Street to Back Bay Station

Two alternatives were considered in this segment:

- o SC-1 (Proposed Alternative) would leave the railroad and rapid transit facility at existing grade.
- o SC-2 would extend the rapid transit (only) in a tunnel from the South Cove Tunnel extension to Dartmouth Street.

Elimination of Orange Line trains by tunneling from the South Cove Tunnel Extension portal to Back Bay Station would have a negligible effect on lowering the average noise level, because of the presence of the Massachusetts Turnpike which is the dominant steady noise source here, and the presence of the very loudest noises caused by locomotives on the railroad right-of-way. Complete elimination of the rail noise without elimination of traffic noise does not solve the problem. For these reasons a suitable solution for protection of houses on

the South End side of the rail right-of-way would be to baffle the Turnpike with a noise wall running from Berkeley Street to Clarendon Street and to baffle railroad noise by extending the railroad passenger platforms as noise attenuating devices.

For the alternative that extends the South Cove subway (SC-2), the covers over the track will provide a noise reduction of approximately 15 decibels in the rail noise, and a 5 to 10 decibel reduction in the Turnpike noise. For the proposed alternative that would place the Orange Line at grade (SC-1), the reduction in rail noise, compared to the baseline case without covers, would be approximately 10 decibels, and the reduction in Turnpike noise would be 10 to 15 decibels In both cases the maximum noise reduction would be at ground level, and the minimum would be at the upper floors of the nearest houses. If the covers are built, noise levels in this neighborhood will become noticeably lower than at present.

Railroad and rapid transit noise levels will be lower than at high speed since all AMTRAK and commuter trains will stop at the platforms adjacent to this neighborhood, and when they are moving it will be at relatively low speeds. The major noise source will be the trains that are pulled by diesels and diesels at idle while stopped at the station. By the year 2000 it is expected that only 25 percent of the trains will be diesel locomotive hauled, and these diesels will be in compliance with the new EPA noise regulations for diesel locomotives.*

6.5.2 Back Bay Station to Massachusetts Avenue Station

The proposed solution to eliminate the noise impact in the South End is to lower the railroad right-of-way approximately four to five feet from its present grade, construct walls at the edges of the right-of-way, and to span the walls with a lightweight deck. In essence, the right-of-way would be in a tunnel that is approximately half above ground and half underground. Viewed from street level, this structure would appear to be six to eight feet tall.

The impacts associated with the proposed solution are discussed in Section 5.5.2.2., Impact Assessment.

*Federal Register, January 14, 1976

6.5.2.1 Additional Solutions

The following discussion describes other possible solutions to eliminate noise impact in the South End that were explored as part of the environmental analysis.

One option that was considered was to keep the Orange Line in tunnel all the way from the South Cove Tunnel to past the Massachusetts Avenue Station. Because both AMTRAK and commuter rail would still be running at the surface, the average noise level would only decrease a few decibels, and the maximum noise levels would be the same. Therefore, from a noise reduction point of view, the benefits are negligible unless further noise control techniques were also implemented for AMTRAK and commuter rail.

The first step for any solution without a tunnel would probably be an extensive program of wheel truing and periodic rail grinding. This would lower Orange Line noise levels by approximately 5 decibels. More importantly, it would lower vibration levels in the adjacent houses. (Vibration levels will be discussed later in more detail.) However, the average sound level for all trains would only be lowered by a few decibels, and the criterion would still be exceeded by more than ten decibels.

For locations at street level and in backyards an extra ten decibels of noise reduction could be obtained with walls approximately ten feet above track level at the edges of the right-of-way. Viewed from the street side, and recalling that the baseline condition calls for lowering the grade by two feet, these walls would appear to be approximately six feet high. The track side of the walls should be treated with sound absorbing material, or the reverberant build-up of sound energy between the walls will degrade their effectiveness. The remaining problem is that noise levels at the windows of the closest residences, where one can look out and see the rail, will still exceed the impact criterion by at least 10 decibels.

In combination with walls at the edge of the right-of-way, the nearby residences could be soundproofed. This would entail double glazed windows and air conditioning.

Walls at the edge of the right-of-way would lower outdoor noise at ground level by 10 to 15 decibels, which meets the criterion. And soundproofing windows that look down on the tracks would reduce interior noise levels to the same extent as lowering outdoor levels to L_{eq} 67db and leaving the windows open.

One question that must be answered is: Which window sould be treated? Because the proposed walls at the edge of the right-of-way will shield lower level windows, one solution might be to only treat those windows from which the wheels of passing trains are visible. Then, once the corridor becomes operational, further treatment could be provided based on actual noise measurements.

Because of concomittant on institutional and operations costs associated with this option, the proposed option was examined which would lower the railroad and the Orange Line below existing grade. In addition, walls at both sides of the right-of-way would be provided as well as intermittent covers with the provision for full cover at a later date.

Several other possible noise control solutions for the South End were explored during the environmental analysis. For the most part, these have been rejected for various reasons. A brief description of some of these is provided below.

A speed limit of approximately 25 mph was one possible solution. It would lower the average noise level by approximately five decibels. However, it is not consistent with the rapid service that AMTRAK and the MBTA would like to provide, and it has the drawback that it is not a permanent solution.

Two other possible solutions that were considered are rail barriers and wheel/rail barriers. Rail barriers would be short barriers (only a few inches higher than the rail) placed on both sides of each rail and faced with a sound absorbing material on the rail side. It is expected that such barriers would provide approximately five to ten decibels in noise reduction at track level*, although they may not be as effective for reducing noise at locations that look down on the top of the rail. The U.S. Department of Transportation has plans to test such barriers to determine their noise reduction potential, but even then they might have to be ruled out because of practical problems such as snow removal. These barriers can only be viewed as a research project; at this time they should not be considered a proposed solution.

Wheel/rail barriers would be three to four foot high barriers placed between each set of tracks, shaped somewhat like station platform sides and lined with sound absorbing material. Although these barriers would work from a noise reduction point of view, they have been eliminated as alternatives because an extra three to four feet would be required between each set of tracks and this would require a 15 to 20 foot taking at the edges of the right-of-way occupied by residential structures or local streets. Wheel/rail barriers might also present problems with snow removal and work crew safety.

6.5.3 Massachusetts Avenue to Forest Hills

South of Massachusetts Avenue there are three basic alternatives for rail alignment: on the Embankment, the Depressed, the Modified-Depressed and the Post-Hearing alternatives. The region of noise impact for the alternatives is best described by the noise contours. They should be viewed to determine the extent of the impact at a specific location. In general terms and in open regions, the extent of the impact for the rail excluding the arterial street (that is, the distance to the L_{eg}67db contours) is approximately 380 feet for the embankment and 80 feet for the full depression. For the Modified Depressed alternative the region of impact would be approximately 80 feet on the east side and 175 feet on the west side. In most cases for the embankment, the contours do not extend out to the full distance but stop at the first row of houses or buildings.

If noise barriers are used on the embankment, the extent of impact will be closer to the extent of impact for the cut, but acoustic decks at two critical areas (at the Mission Hill and Bronley-Heath Housing Developments) cannot be installed in the embanked alternatives without further amplifying the visual barrier effect.

The embankment barriers should be as close to the outside tracks as possible and approximately six to seven feet high, which would increase the visible height of the embankment by that amount. They do not have to be so high that they block the view of train passengers. In the critical areas discussed below, the track side of the barriers should be treated with sound absorbing material.

---

*"Wheel/Rail Noise and Vibration", U.S. Department of Transportation, Report No. UMTA-MA-06-0025-75-11, May, 1975.

If the embankment alternative is selected, it is recommended that noise barriers be built. There are some locations where buildings not sensitive to noise abut the right-of-way and the requirement for barriers could be relaxed here. However, for the greater portion of the alignment, six to seven foot high barriers should be included in the design.

In general, noise control for the west side of Modified Depressed and Post-Hearing alternatives, when that side has a lower wall, is complex. Some additional noise reduction will be achieved if a low solid concrete safety wall is used at the edge of the right-of-way instead of a wire fence. This wall could be an extension of the walls of the cut and grading adjusted to slope covering part of the wall. In noise sensitive areas the wall of the cut should be treated with sound absorbing material.

For any of the depressed alternatives, even with noise barriers on the embankment, there may still be some noise impact at the following locations: Northeastern University and Carter Playground, Mission Hill Housing, Bromley-Heath Housing and the Boston Gas/High School site, unless specific measures are taken.

The measured peak hour L_{eq} sound level at the Ell Center at Northeastern University was 74db. The expected design year noise levels here and at Carter Playground to the south of the tracks will be similar to present conditions.

For all depressed alternatives the alignment will be in a shallow cut. This is one location where the walls of the cut should be extended approximately five feet above the adjacent ground level to provide additional noise reduction. For the Embankment alternative the alignment will be approximately at the present grade. Six to seven foot high noise barriers are strongly recommended here for the Embankment alternative. For all of the alternatives, consideration should be given to treating the walls of the cut (or the inside of the barriers) with sound absorbing material at this location.

At Mission Hill the problem is similar to the South End - high close-up buildings look down on the tracks from above. The measured peak hour L_{eq} s level here was also 74db, and without special treatment, noise levels in the design year will be similar. Noise levels on the ground are not the main problem because the noise reduction afforded by either the cut or noise barrier walls on the embankment. The problem is reducing the noise at the apartments that look down on the tracks from high above. A deck over the tracks in this area is proposed in all the depressed alternatives. It would completely solve the noise problem. If the deck were not built or if it were not extended the whole length of the Mission Hill Housing complex, then the following solution would be required. The walls of the cut (or the inside of the noise barriers at the edge of the embankment) should be covered with sound absorbing material. A wall between the Orange Line tracks and the railroad tracks at the station is already required; therefore, the above solution would be an addition to that wall.

At Bromley-Heath, the problem is almost identical to the problem at Mission Hill, although not quite as many housing units are involved. Again, a lightweight deck over the trains is the proposed solution; it would also completely solve the noise problem at this location. If the deck were not built, the noise reduction technique described above for the Mission Hill complex would also have to be used at the Bromley-Heath location.

The Boston Gas site has been proposed for use as a High School. It has a similar problem in that it is also up close to the right-of-way and has windows that look down on the tracks. Since this building will be renovated before the proposed project becomes operational, sensitive rooms should not be placed on the track side of the building, and good soundproofing windows should be used. UMTA has no specific guidelines for playgrounds, but FHWA classifies playgrounds in the same land category as residences. The design noise level for this category is L_{eq}67db. To satisfy this design level at new playgrounds and the Johnson Playground, noise barriers on the embankment or extended sidewalls or slopes should be used. Again, the extended walls should be at least five feet above the

adjacent ground level. Current plans for the High School include air conditioning and a minimum number of windows (these with a special design) on the side of the building facing the rail and arterial corridor.

The table in Fig. VI-12 presents a summary of the number of people impacted by each of the proposed alternatives. The number of people listed in the table for the No-Build alternative include those now impacted by rail noise along the Penn-Central alignment and those now impacted by Orange Line noise between Dudley Station and Forest Hills.

Removing the Orange Line from Washington Street will not totally eliminate the noise impact because of traffic noise, but the noise impact will be substantially reduced.

Noise impact as measured in L_{eq} values along the Penn Central alignment, without special noise control techniques, would be approximately equal to the present. If noise levels for trains in the future are quieter, as predicted, the number of persons affected will be less.

6.5.4 Arterial Street Impacts

On a neighborhood-wide basis the proposed arterial is not expected to increase noise levels significantly over existing conditions, as the total amount of traffic will remain nearly the same. In Segment II, where the arterial would replace the present Columbus Avenue, the arterial street noise will be approximately equal to the present Columbus Avenue road noise. If an arterial is built here, the combined noise of the arterial and rail operations will be slightly greater, in this immediate location, than with the rail facility alone.

No special noise control devices are expected to be used for the arterial road. The primary reason is that the most common noise device, noise barrier walls, are not compatible with urban roads. Barriers would have to be at least ten feet high to work effectively; even then they could not be continuous at intersections, and thus their effectiveness would be greatly compromised. Furthermore, the projected impact is minimal. The impacted zone is at most 130 feet on either side of the road. This area is largely cleared. At present, the FHWA has recognized that most noise control techniques are generally incompatible with non-limited access urban roads, and, accordingly, does not require formal exceptions to the design noise levels for such roads.

It should be mentioned that one very effective noise control technique, namely quieting the vehicles themselves, although effective, cannot be undertaken on a project-by-project basis. This type of an approach is, however, being undertaken by the Federal government on a national level. The U.S. Environmental Protection Agency has proposed regulations that will require a gradual reduction in the noise levels of new medium and heavy trucks in the next ten years. This should help reduce future noise levels even below the predicted levels.

6.6 Adverse Community Impacts

Community Impacts fall into several categories; visual, noise, communication between neighborhoods, provision of sites for development, pedestrian movement, and acquisition of households and businesses. All alternatives require land acquisition. See Fig. V-38 for the number of takings and Section 6.6.6 for procedures.

The following sections discuss the impacts of the alternatives on Jamaica Plain, Roxbury, and the South End insofar as they are adverse and briefly discuss the measures taken to reduce them.

6.6.1. Embankment Alternatives

- The embankment will become higher and wider with noise walls and catenary wires added. This will increase the barrier effect and perpetuate artificial community divisions. Underpasses should be as numerous as possible and they should be made as visually open and light as possible.

- Embankment sides are difficult to keep clean and free of litter. Where possible, terrain should be sloped gently to make the land useful and therefore more likely to be maintained. Alternatively, a retaining wall could be used to permit leveling the adjacent land. Where embankment slopes remain visible, large and durable landscape materials should be chosen. Cleaning and maintenance responsibilities should be clearly established.

- Embankment slopes and retaining walls cast shadows which can present security problems and traffic hazards, especially just after dawn and just before dusk. Walls should be light colored and artificial lighting should be provided at key locations with special extended operating hours.

- The embankment slopes reduce the utility of several of the open spaces, especially where level play areas are at a premium. Where possible, the alignment should be adjusted to preserve existing retaining walls. In certain critical areas, new retaining walls or cribbing could be used to avoid encroachment.

- The embankment slopes reduce the utility of some of the land to be developed. In some critical areas it may be justifiable to use retaining walls or cribbing where definite uses for the land are established.

- Noise pollution, air pollution, and visual impact of significant increases in numbers of moving trains will extend much farther into the community (see Fig. VI-12). Negative effects on existing real estate will remain as at present or even become worse because of more frequent train operations. The same negative effects will restrict new development and rehabilitation. Banks may compound the negative impact by becoming more reluctant to lend mortgage and home-improvement money. Special measures may be necessary to influence lending institutions to continue to support the neighborhood. Noise walls and 100 percent electrification would help to reduce the original physical impacts, but depression of the tracks would do more to reduce physical impacts.
- The embankment will prohibit any air-rights development and will sharply inhibit the construction of additional pedestrian or vehicular crossings in the future. Therefore, there should be as many crossings provided as possible--even in excess of current demonstrable needs. The loss of air-rights opportunities cannot be directly compensated.

- The lack of incentive to development of nearby vacant land may result in much of this land remaining vacant for a long time. This carries with it the maintenance and policing problems which are already apparent in the Corridor. Some provision should be made to insure that this land be maintained and policed and not be allowed to become a blighting influence on the whole neighborhood.

- There is less retail space available at station locations, particularly in the Forest Hills station complex. This space can be created within the stations in all depressed alternatives.

- Open space and landscaping will be visible to fewer people because of the visual obstruction of the embankment. This could be compensated for by increasing the amounts of landscape materials and by landscaping the embankment sides.

- Visual control of the bikeway and walkways will be reduced by the embankment. Therefore, these elements should be planned with special concern for visibility and security. Artificial lighting and increased police patrolling could offset this problem somewhat.

- Underpasses pose a security problem because there are always blind corners as a pedestrian passes through. Underpasses could be made wider, and corners could be rounded to make it harder for persons to hide from view.

- Street intersections and pedestrian crossings will be more dangerous because drivers and pedestrians will not have full peripheral vision before arriving at the intersections. Traffic controls and intersection designs should take this into account.

- Fencing is necessary to provide safety for train operations.

6.6.2. Depressed Alternatives

- The increase in the volume of rail traffic could cause adverse impacts in the categories of noise and vibration. These impacts would be mitigated by measures to reduce noise and vibration which are discussed elsewhere. The depression of the rails and sound-reducing decks adjacent to high-rise housing locations are additional impact mitigation factors and often eliminate even the current impacts (See Fig. VI-12).

- Some unsightly land uses will become more visible. Landscaping can be designed to mitigate this. Community pressure may eventually cause these land uses to screen themselves or to move away. Greenbelt construction can be designed to hide these uses.

- In the build-street alternative, the embankment will not be available to mask the environmental effects along one side of the street.

- Fencing is necessary to provide safety for train operations particularly at bridge overpasses.

6.6.3 Modified Depressed Alternatives (including Post-Hearing Profile)

- The raising of grades on certain streets that cross the depressed rails will result in some visual discontinuity as one looks along the street. Traffic signalization, street lighting, and pedestrian crossings would be designed to compensate for these effects on sightlines at Green, Boylston, McBridge and Williams Streets.

- Raised cross streets and the raised arterial will have sloped land running up to them which could have come of the same maintenance problems as the embankment. Slopes should be kept as gentle as possible and landscaping should be carefully done to insure utility and proper maintenance.

- Retaining walls along certain raised streets may create accumulation points for litter and potentially hazardous zones. To the extent possible, land at the foot of these walls should be conveyed to private parties or public agencies who would have clear responsibility for controlling the area.

The Modified-Depressed and Post-Hearing alternatives include some slopes down to a lower wall at the tracks instead of high vertical walls at several locations. These depressions will tend to accumulate litter. These slopes should be fences in order to limit vehicle access into park areas.

- Fencing is necessary to provide safety for train operations particularly at bridge overpasses.

6.6.4. Build Street Alternatives

- The build-street alternatives will have environmental consequences described elsewhere in this report. Generally, there will be reductions of similar environmental effects on other neighborhood streets where traffic flows are reduced. A landscaped buffer strip has been provided to lower noise levels by setbacks.

- Traffic flow on the arterial will in itself be an obstacle to cross-corridor movement. Frequent stop lights with pedestrian cycles could mitigate this problem. North of Jackson Square the existing total street width would be reduced because Tremont Street is eliminated so cross corridor movement will be enhanced somewhat in that area.

- Traffic flow on the arterial presents safety hazards to neighborhood children. Careful landscaping and detailed design can reduce the likelihood of children inadvertently running into the street. Nothing will be built within the buffer strip between transit and street which would attract pedestrians. Pedestrians will cross the arterial only at bridge locations when there are traffic controls.

- With the street alternatives, about one-third of the open space is near the arterial and therefore not suited for uses such as playfields. It can, however, provide the right-of-way for bikeways and sidewalks which would otherwise impinge on the active-use areas. The balance of the open space should be developed somewhat more intensively than otherwise to insure provision of a comparable amount of playfield capacity.

  There is less land available for auto-oriented commercial use in the build street alternatives. This is not necessarily bad since these are land uses of marginal quality from the community viewpoint. There are other ample opportunities around the city for such development.

- The arterial tends to increase traffic flows on cross streets. Traffic controls and intersection designs should take this into account. Parking restrictions may be helpful in reducing congestion on these cross streets.

- North-South traffic flow will be redistributed between Forest Hills and Ruggles Street. Traffic controls and pedestrian bridges should mitigate this problem to a degree but would concentrate traffic volumes on new streets and provide some relief to others. Coincidentally, the traffic volume could stimulate the retail activities in the area making available a wider variety of goods and services. In addition, traffic relief to Centre and South Streets would improve service on the Arborway Green Line.

No-Build Street Alternatives - Jamaica Plain

- There will be less exposure of land to traffic and therefore less retail market potential in the corridor. Commercial sites are limited in any case, even with the arterial.

- Retail and other commercial real estate will be harder to market because of lack of access and poor visibility. Special corridor-wide marketing efforts could help this situation somewhat in the short term, and residential areas will benefit by less traffic.

- Open space will be more unsafe because of reduced visibility and difficulty of direct patrolling by police and passers-by from autos. Landscaping should be designed for easy visual surveillance from nearby houses and streets. There should be a through route for patrol cars. Articifical lighting should be provided.

- Traffic remaining on neighborhood streets will remain bad and probably get worse. Measures could be taken to improve traffic flow, especially on Washington Street where the elevated structure will be removed, and some deliberate removing of traffic might be possible if increases on other streets were tolerable.

- There will be traffic congestion around the stations. Careful design at or near the stations can reduce this impact. Some other street modifications may be needed nearby.

No-Build Street Alternatives - Roxbury

- These alternatives keep the existing street patterns, between Jackson Square and Ruggles Street. The land parcels resulting from the existing configurations are not conducive to improved land use in the area. The build-street alternatives produce land parcels which are more suited to modern development than those now existing in the corridor.

The arterial must be constructed in the Modified Depressed and Post-Hearing Alternative in Roxbury since Columbus Avenue is too low to allow access over the rapid transit/rail facility.

6.6.5 South End Transit/Rail Alternatives

The most significant adverse impact on the South End might be noise that will be generated by a higher volume of rail traffic than at present. Noise attenuation measures are discussed in other sections, and if implemented as proposed, will effectively reduce or eliminate such adverse impacts including those currently existing.

Land acquisition in the Back Bay Station area under Alternatives SC-1 and SC-2 will require relocation and demolition. The redevelopment of these parcels will aid in healing the scars of demolition. If open space is the chosen use for these parcels, the end walls of properties abutting the acquired parcels must be treated in an appropriate architectural manner and landscaping and fencing must be carefully accomplished.

6.6.6 Acquisition of Properties

Various residential, business, and vacant-land parcels are required under the different alternatives. These acquisitions are listed by alternatives described in Figure V-38. A Conceptual-Stage Relocation Plan is available from MBTA which describes adequate provisions for the relocation of the specific households and businesses potentially affected by the various alternatives.

A summary of the Uniform Relocation Act of 1970 and the Federal and State relocation requirements follows.

Federal and State Requirements

Federal law (Uniform Relocation Act of 1970), state law (Chapter 79A Massachusetts General Laws), regulations of the Federal Highway Administration (PPM 81-1), and regulations of the Massachusetts Bureau

of Relocation provide that any highway or transit project that will involve the relocation of families or individuals must assure the following:

> There will be available sufficient decent, safe, and sanitary homes for sale and rent, adequate to meet the needs of each family to be relocated and within their financial means. In determining whether sufficient suitable housing will be available for relocation, the following criteria are applied (required by federal or state regulation):
>
> - Replacement housing must be decent, safe, and sanitary, as defined by Article II, Massachusetts Sanitary Code.
>
> - The cost of replacement houses must be within the financial means of households to be relocated. As a minimum, gross housing costs per year are not to exceed 25 percent of gross annual income.
>
> - Housing meeting the above standards must be available in locations that are in the same general area, accessible to the relocatee's place of employment, in a neighborhood that is equal to or better than the one in which the family lives, comparable with regard to public and commercial facilities, etc., and adequate to accomodate any of his special needs.
>
> - Replacement dwellings must be at least comparable to dwellings to be acquired, with respect to number of rooms, area of living space, type of construction, a age, and state of repair.
>
> - Each household must have, as a minimum, three suitable choices for relocation.
>
> These criteria are applied to the overall supply of housing anticipated to become available, and in later phases - prior to the right-of-way acquisition - estimates of available housing suitable to the needs of relocatees would be developed "to the extent necessary to assure that a relocation plan can be expeditiously and fully implemented", and to satisfy all requirements of state law and regulations of the Massachusetts Bureau of Relocation. Under federal law, if sufficient suitable dwellings could not be anticipated to become available in existing housing, then new housing must be built as necessary to accomodate all relocatees.
>
> A program of "relocation advisory services" is in effect, including a staff of qualified professionals, that will assist people in finding homes suitable to their needs.
>
> Under state law, the Massachusetts Bureau of Relocation must qualify an agency to assist persons displaced in finding housing and to disburse payments. An adequately sized staff of professional relocation workers is required to be available at times and places convenient to relocatees. According to federal law, the following "relocation advisory services" must be provided: a) personal interview to determine precise needs, b) referral to appropriate sales or rental housing, c) assistance in applying for relocation payments and other service, and d) advice and counseling on an individual basis as needed.

Other assistance to eligible relocatees guaranteed by law includes priority for low-rent public housing units, priority for moderate income units, and priority for rent supplement and leased housing programs.

Relocation payments authorized by law are to be promptly paid to all eligible persons. Benefits to eligible families and individuals include:

- Payment for the actual cost of moving, or an amount (up to $500) based on a predetermined schedule. Families may elect whichever moving payment best serves their needs.

- Payment to a homeowner (up to $15,000 over and above payment given for the fair market value of his home) to enable him to purchase and finance a home comparable to the one he lived in.

- Payments to a tenant (up to $4,000 over a 4-year period) toward his new rental, or toward a down payment if he chooses to purchase a home.

Simply stated, relocation programs express a relationship between the housing needs of displacees and the availability of housing to meet those needs. Relocation is most easily accomplished, and choice is afforded for replacement housing, when housing market activity matches relocation needs and when the additional demand created by displacement is small enough to be absorbed without severe consequences to the overall market or some segment of the market. It follows, therefore, that the kind of housing desired by relocatees must be available in sufficient numbers to assure that relocation needs and preferences will be adequately provided for. Unfortunately, precise needs and preferences cannot be determined at this early stage, nor can the availability of suitable housing be estimated with strict accuracy. However, past experience has shown that most households seek homes comparable to what they owned or rented prior to relocation, and FHWA has adopted standards of "comparable replacement housing" that reflect, in part, such experience. This criterion, as well as additional Federal and state standards for relocation housing, has been applied to the extent possible in determining at this preliminary stage the probable availability of housing for potential relocatees. The following factors have been considered:

- Number and type of dwellings affected, tenure and size of households, age and other characteristics of affected residents.

- Location and approximate value of dwellings to be acquired.

- Neighborhood characteristics.

6.6.7 Relocation and Land Requirements

The various alternatives for the Project would necessitate the taking of several properties in the South End, Roxbury and Jamaica Plain in the City of Boston.

For details of these proposed takings, refer to Figs. VI-13, 14, and 15. These figures include only properties which will be affected by either (1) a full taking which will displace the households or businesses occupying them, or (2) a

partial taking which will not displace the household or business but may affect the use of the property. Takings which affect vacant buildings or land are not discussed in this report since its focus is on relocation.

Several properties in the Project area already belong to the Commonwealth of Massachusetts as they were taken for Route I-95 a number of years ago. Relocation from these state-owned properties is dealt with in Appendix K. Other properties affected are also listed in Appendix K.

The various alternatives for the Project require different amounts of relocation. These are shown in Figure VI-15. The preferred alternatives are PHP-1 and PHP-2.

Alternative PHP-1 would result in the displacement of 12 residential structures containing 62 units; it would affect 33 businesses, with 19 businesses being displaced.

Alternative PHP-2 would result in the same residential displacement - 12 structures containing 69 units. This combination of alternatives would affect 38 businesses, with 21 businesses being displaced.

6.7 Adverse Visual Impacts

The criteria for the analysis of the visual impact of expanded transportation facilities in the Corridor respond to the continuity, character, and scale of existing districts along its length and, the measures which must be taken to maintain the integrity of such districts.

The present rail corridor and embankment is an unavoidable intrusion to the intimate scale and the desirable character of these residential districts. However, through the use of landscape and urban design devices, including tree planting, lighting and the development of linear open spaces and bike paths, the modified embankment could be made more attractive than the present one. The modified embankment would be 2 to 4 feet higher without noise barriers and 8 to 11 feet higher with noise barriers. This height would be hard to mask or otherwise avoid as a presence in the neighborhoods. Its additional height would place it about 26 to 30 feet higher than grade in many areas. This is equivalent to a continuous 3 1/2 story building often several thousand feet long. The current embankment is constantly covered with graffiti, and there is reason to believe that a new higher one would otherwise become a billboard for such unsightly acts of vandalism.

The increased height of the embankment would further reduce sight lines across the wall. Its so called "Chinese Wall" affect would be increased and small areas adjacent to it would further be encroached upon visually. The Albert Street Playground and the several houses which abut it would feel its bulk to an even greater extent.

In depressed options, the problem is simplified in that the great bulk of the embankment is no longer a factor. The discontinuity that a large open depression presents must be addressed. Design implications in the depressed option include the opportunity to bridge and to deck. Such techniques not only increase development potential, but provide visual and functional linkages across the Corridor. Further, landscaping, open space treatment and careful attention to the detail and character of the side walls and safety barriers (particularly in the sensitive historic districts which abut the Corridor in the South End) will ameliorate the overall visual impact of the project.

The Post-Hearing Alternative would approximate the fully Depressed Alternative in its effect upon cross-corridor vision. It would present a primarily flat terrain when viewed from Roxbury between Ruggles Street and Jackson Square since adjacent grade to the east would be raised. From the west, the view from Northeastern University would be of a low wall unless the university parking area were regraded. This could be accomplished as a part of the proposed project.

From the Mission Hill Housing development, the Modified Depressed Alternative would appear as an 8-foot low wall with a recreation area above, since the acoustic deck proposed would be landscaped. This wall is reduced to a slope in the Post-Hearing Alternative.

From Terrace Street in Mission Hill to the Lamartine Street Extension, and Lamartine Street in Jamaica Plain between New Heath Street and Mozart Street, all Depressed Alternatives would be below grade and present a fully depressed appearance.

From the west, between Mozart Street and McBride Street, the grading of the transit facility would appear alternatively as a landscaped gradual slope or a variable height retaining wall (0 to 10 feet) due to regrading of local streets which must cross over the depressed rails. Most of the Post-Hearing Alternative would be virtually indistinguishable as being at higher grade because of the gradual landscaped treatment of the slopes.

From the east, between Centre Street and Boylston Street, the transit facility or arterial (if built) would be behind existing buildings and graded with landscaping at a gradual angle. From the east between Boylston Street and McBride Street it would be visible either as a landscaped slope dropping to the rail facility or as gradual slope and low retaining walls running up to the arterial facility at a varying height from 0 to 8 feet above former grade. Visually, the actual height would appear much less due to gradual regrading of slopes. This view would be blocked by existing industrial uses from Amory Street between a point about 200 feet south of Boylston to roughly Minton Street; at the American Cellophane and Boston Gas, and Kinney Vaccuum Companies. Of a total length of 5,500 feet only 2,150 feet would be visible at all between Boylston and McBride Streets because of large intervening structures that abut the tracks.

South of McBride Street slopes gradually rise to the transportation facilities on the west and industrial uses abut it on the east.

Comparing the expanded embankment with the depressed options, it is evident that no specific design configurations will significantly mitigate the unusual impact of the former. The expanded embankment will remain essentially a physical and visual barrier between communities and even increase in width. Although a number of open and light connections are planned at street crossings and station points, the inevitable "tunnel like" nature of these passages will remain a problem.

6.8 Adverse Fiscal Impacts

The MBTA does not plan any change in the assessment formula because of this project.

Operating cost impacts are discussed in Section 4.

Increase in costs of operation for railroad shuttle and bus alternatives during construction are tabulated in Section 6.2.9.5. . The net loss of these due to capital requirement in equipment or track work, would be eligible as project capital costs and subject to Federal reimbursement.

Some net saving in commuter rail operation costs on the Needham Branch is anticipated by bus substitution (see Fig. VI-1). Loss, if any, in patronage and revenue on other railroad branches during the construction period is impossible to estimate though substitute shuttle service to Back Bay from South Station should minimize this effect.

(Fig. VI - 1)

COMPARISON OF AVERAGE EMISSION FACTORS FOR BULLDOZERS AND MOTOR VEHICLES IN THE SOUTHWEST CORRIDOR (grams/hour)

Criteria Pollutant	Bulldozer	Motor Vehicle	Ratio (B/MV)
Carbon Monoxide	340	970	0.35
Hydrocarbons	110	120	0.92
Nitrogen Oxides	2300	82	28.0
Sulfur Oxides	160	5.2	31.0
Particulates	75	17	4.4

(Fig. VI - 2)

TRAVEL TIMES SOUTH STATION/BACK BAY

	To Back Bay From South Station	To South Station From Back Bay
Alternative A*	6 minutes	6 minutes
Alternative B	6 minutes	6 minutes
Alternative C	16 minutes	16 minutes

(Fig. VI - 3)

RANKING OF SHUTTLE ALTERNATIVES FROM CONVENIENCE AND RELIABILITY STANDPOINTS

	Alternatives		
	A*	B	C
Schedule Adherence	1	2	3
Walk time between trains and shuttle	1	2	2
Waiting time between trains and shuttle	2	1	1
Convenience of Back Bay locations served	3	2	1

1 = highest ranking (most favorable of the alternatives)
3 = lowest ranking (least favorable of the alternatives)

An alternative with a lower numerical ranking in a category is superior to an alternative with a higher ranking. In some instances, two alternatives have the same rank in a particular category. This means that neither alternative is superior to the other from this particular standpoint.

*Alternative "A" (Railroad Shuttle) is the proposed service during construction.

(Fig. VI - 4)

TOTAL COST IN 1975 DOLLARS

FOR SOUTH STATION TO BACK BAY

SHUTTLE ALTERNATIVES

	ALTERNATIVES		
	A	B	C
Operating Expenses[1]	$921,000	$681,000	$852,000
Capital Expenses			
Construction	190,000	1,850,000	-
Rolling Stock	33,000	409,000	580,000
TOTAL EXPENSES	$1,144,000	$2,940,000	$1,432,000

[1]Assumes a 4 percent discount rate. Operating expenses are the total expenses for providing service over a four year period (the expected duration of the construction phase of Orange Line Relocation).

(Fig. VI - 5)

SERVICE FREQUENCIES AND CAPACITIES INBOUND FROM NEEDHAM

	Bus Alternative			Current Rail Service		
	Departures	Seated Capacity	Demand	Departures	Seated Capacity	Demand - Needham Stations
Weekday						
Peak Hour (AM)						
To South Station	9	450]	580			
To Copley	3	150]				
To South Station				3]	1350]	660
Peak Period (AM)						
To South Station	14	700]	770			
To Copley	3	150]				
To South Station				5]	1710]	780
Daily						
To South Station]	30]	1500]	800			
To Copley						
To South Station				12]	2250]	810
Weekend						
To South Station]	10]	500				
To Copley]						
To South Station				7]	630	

(Fig. VI - 6)

TRAVEL TIME COMPARISON-BUS VS. COMMUTER RAIL (MINUTES)

Time of Day	Bus Alternative AM Peak	Commuter Rail AM Peak	Bus Alternative Midday	Commuter Rail Midday
To: South Station				
From Needham Heights	41	42	43	40
Needham Center	37	39	39	36
Needham Junction		36	35	31
Birds Hill	32	33		28
To: Copley				
From Needham Heights	41	38	32	36
Needham Center	37	35	28	32
Needham Junction		32		27
Birds Hill	32	29	24	24
From: South Station				
To Needham Heights	27	36	34	36
Needham Center	30	33	38	33
Needham Junction		30		30
Birds Hill	36	27	42	27
From: Copley				
To Needham Heights	23	31	20	32
Needham Center	27	28	24	29
Needham Junction		25		26
Birds Hill	32	22	28	23

(Fig. VI - 7)

MOCK SCHEDULE

	AM Peak			Midday		Midday Return	
Alternative A	Bus to South Station	Bus to Copley	Commuter Rail	Bus	Rail	Bus	Rail
Needham Heights	7:26	7:22	7:25	11:57	12:00	3:34	3:36
Needham Center	7:30	7:26	7:28	12:01	12:04	3:38	3:33
Birds Hill	7:35	7:31	7:34	12:05	12:12	3:42	3:27
Copley		8:03	8:03	12:29	12:36	3:14	3:04
South Station	8:07		8:07	12:40	12:40	3:00	3:00

(Fig. VI - 8)

TRAVEL TIMES TO BOSTON

Station Vicinity	Via Needham Branch	Via Feeder Bus and Orange Line
West Roxbury	27 minutes	34 minutes
Highland	25 minutes	32 minutes
Bellevue	22 minutes	29 minutes
Roslindale	19 minutes	24 minutes

(Fig. VI - 9)

COMPARISON OF ANNUAL EXPENSES AND REVENUE FOR RAIL,

NEEDHAM EXPRESS BUS, AND FEEDER BUS SERVICE TO FOREST HILLS

(All Numbers Are Expressed in 1975 Dollars)

1) Needham Express Bus Fare of $1.00

	Needham Express Bus	W. Roxbury Feeder Bus	Sum of Bus Services	Commuter Rail
Operating Expenses	$703,100	$115,100	$818,200	$1,217,300
Revenue	442,000	161,200	603,200	592,000
Expenses Minus Revenue	261,100	(46,100)	215,000	625,300
Capital Cost Amortized	122,000	103,200	225,200	0
Net Annual Expenses	383,100	57,100	440,200	625,300

2) Needham Express Bus Fare of $1.25

	Needham Express Bus	W. Roxbury Feeder Bus	Sum of Bus Services	Commuter Rail
Operating Expenses	$703,100	$115,100	$818,200	$1,217,300
Revenue	552,500	161,200	713,700	592,000
Expenses Minus Revenue	150,600	(46,100)	104,500	625,300
Capital Cost Amortized	122,000	103,200	225,200	0
Net Annual Expenses	272,600	57,100	329,700	625,300

Parenthesis indicate that revenue exceeds operating expenses.

(Fig. VI - 10)

COMPARISON OF ANNUAL EXPENSES AND REVENUE FOR RAIL, NEEDHAM EXPRESS BUS, FEEDER BUS SERVICE TO FOREST HILLS, AND WEST ROXBURY/ROSLINDALE EXPRESS BUS

(All Numbers are Expressed in 1975 Dollars)

1) Needham Express Bus Fare of $1.00

	Needham Express Bus	W. Roxbury Bus (Feeder and Express)	Sum of Bus Service	Commuter Rail
Operating Expenses	$703,100	$231,700	$872,000	$1,217,300
Revenue	442,000	156,000	598,000	592,000
Express Minus Revenue	261,100	75,700	274,000	625,300
Capital Cost Amortized	122,000	112,600	234,600	0
Net Annual Expenses	383,100	188,300	508,600	625,300

2) Needham Express Bus Fare of $1.25

	Needham Express Bus	W. Roxbury Buses (Feeder and Express)	Sum of Bus Service	Commuter Rail
Operating Expenses	$703,100	$231,700	$872,000	$1,217,300
Revenue	552,500	156,000	708,500	592,000
Express Minus Revenue	150,600	75,700	163,500	625,300
Capital Cost Amortized	122,000	112,600	234,600	0
Net Annual Expenses	272,600	188,300	398,100	625,300

Parenthesis indicate that revenue exceeds operating expenses.

(Fig. VI - 11)

COMPARISON OF ANNUAL EXPENSES AND REVENUE FOR RAIL, NEEDHAM EXPRESS BUS, FEEDER BUS SERVICE TO FOREST HILLS, AND WEST ROXBURY/ROSLINDALE EXPRESS MINIBUS

(All Numbers Are Expressed in 1975 Dollars)

1) Needham Express Bus Fare of $1.00

	Needham Express Bus	W. Roxbury Buses (Feeder & minibus)	Sum of Bus Service	Commuter Rail
Operating Expenses	$ 703,100	$ 303,300	$ 943,600	$ 1,217,300
Revenue	442,000	158,600	600,000	592,000
Express Minus Revenue	261,100	144,700	343,000	625,300
Capital Cost Amortized	122,000	123,500	245,500	0
Net Annual Expenses	383,100	268,200	588,500	625,300

2) Needham Express Bus Fare of $1.25

	Needham Express Bus	W. Roxbury Buses (Feeder & minibus)	Sum of Bus Service	Commuter Rail
Operating Expenses	$ 703,100	$ 303,300	$ 943,600	$ 1,217,300
Revenue	552,500	158,600	711,100	592,000
Express Minus Revenue	150,600	144,700	232,500	625,300
Capital Cost Amortized	122,000	123,500	245,500	0
Net Annual Expenses	272,600	268,200	478,000	625,300

Parenthesis indicate that revenue exceeds operating expenses

(Fig. VI - 12)

SUMMARY OF NOISE IMPACTS

NUMBER OF PEOPLE IMPACTED BY RAIL/TRANSIT AND ARTERIAL STREET NOISE*

	Rail/Transit Only	Rail/Transit & Arterial St
I. No Build**	1270	n.a.
II. Build		
A. South Station to Mass. Avenue		
1. New alignment at two feet below present grade without extra noise control	420	n.a.
2. Walls at edge of right-of-way with solid deck (Proposed Project)	0	n.a.
3. Walls at edge of right-of-way with intermittent deck and soundproofing of limited number of adjacent structures	0	n.a.
B. Massachusetts Avenue to Forest Hills		
1. Embankment without noise barriers	750	1064
2. Embankment with wall noise barriers***	690	1004
3. Depressed or Modified Depressed Alternatives****	80	136
4. Depressed Post-Hearing Profile Alternatives*****	69	125

* These numbers indicate the number of persons dwelling within $L_{eg}67$ Line as illustrated on the Project Alternatives. Total automobile and tr ck traffic noise impact is expected to remain relatively constant and is only counted where impacts are greater than present. This only occurs in Segment #3. In order to compute these numbers it was assumed that the average number of residents per unit was 3.5 in Roxbury and Jamaica Plain and 2.5 in the South End.

** The value for the no-build alternative includes not only the impact adjacent to the proposed alignment but also the rail impact adjacent to the present Orange Line from Dudley Station to Forest Hills. That section of the present Orange Line would be directly eliminated and not replaced if any of the build alternatives are implemented.

*** No acoustic deck is possible at Mission Hill and Bromley Heath in the embanked alternative.

**** Includes acoustic deck constructed at Mission Hill and Bromley Heath.

***** Includes acoustic decks constructed at Mission Hill, Bromley Heath, McBride/Williams Streets and Oakdale/Lorene Road.

(FIG. VI-13)

INVENTORY OF AFFECTED STRUCTURES
POST HEARING ALTERNATIVES PHP-1 & 2 (exceptions noted)

Address	Type of Structure	Estimated Tenure	Estimated Vacancy	General Condition	Assessed Value of Property, 1974
Residential					
18 St. Charles Street South End	3½ story brick	1 owner 2 renters	not known	good	$ 8,000
20 St. Charles Street	3½ story brick	1 owner 2 renters	not known	good	9,300
20 Cazenove Street South End	4 story brick	16 renters	not known	good	35,000
26 Cazenove Street	4 story brick	16 renters	not known	good	35,000
256 Columbus Avenue South End	4 story brick	7 renters	not known	good	52,000
3834-3836 Washington St.	2 story frame	1 owner 1 renter	occupied	fair	3,000
117 McBride Street Jamaica Plain	1½ story frame	1 owner	occupied	good	1,800
123 McBride Street	1½ story frame	1 renter	occupied	good	1,900
129-131 Boylston Street Jamaica Plain	3 story frame	6 renters	occupied	fair	15,000

Fig. VI-13 (con't)

Address	Type of Structure	Estimated Tenure	Estimated Vacancy	General Condition	Assessed Value of Property, 1974
133-135 Boylston Street Jamaica Plain	3 story frame	1 owner 2 renters	occupied	good	4,600
301-303 Highland Street Jamaica Plain	3 story brick	1 owner 1 renter	occupied vacant	fair	5,000
142 Carolina Avenue Jamaica Plain	3 story frame	2 renters	occupied	good	4,000
<u>Business</u>					
95 Perkeley Street South End	Partial Taking: 2 story corrugated steel shed next to rail line	owner (Morgan Memorial)	occupied	fair	435,000
90 Berkeley Street	4 story brick	owner (John Stuart Inc.)	occupied	good	165,400
254-256 Columbus Avenue South End (see Note 1)	4 story brick	--	store vacant	good	
258-260 Columbus Avenue South End (see Note 1)	4 story brick	renter (Mac Ellis Tires)	occupied	good	52,000
262-264 Columbus Avenue	1 story brick	renter (Garnet Lounge)	occupied	good	
75 Clarendon Street South End	Partial Taking: corner of gas station lot	renter (Liberty Service Station)	occupied	no structure involved	48,000

Fig. VI-13 (con't)

Address	Type of Structure	Estimated Tenure	Estimated Vacancy	General Condition	Assessed Value of Property, 1974
238 St. Botolph Street	Partial Taking: parking area	owner (Boston Arena Authority)	occupied	no structure involved	400,000
Adjacent to 6 Gainsborough Street	Partial Taking: parking area	owner (North-eastern Univ.)	used	no structure involved	--
41 Amory Street Jamaica Plain	Partial Taking: no sturcture involved (PHP-2 only)	owner (Cappy's Towing & Wrecking)	occupied	good	36,000
Ruggles Street at Columbus Avenue Roxbury	Parking area	owner (North-eastern Univ.)	used	no structure involved	n.a.
Ruggles Street at Forsyth Street Roxbury	Parking area: Partial Taking	owner (North-eastern Univ.)	used	no structure involved	n.a.
154-160 Green Street Jamaica Plain	2 & 3 story frame	renters (Fran & Pat's Sub Shop; Arsenault Saw Service; Arkin Furniture Co.)	occupied	fair	12,500
109 Lamartine Street Jamaica Plain	3 story frame	owner (assumed) (Corner Tavern, Inc.)	occupied	fair	7,000
126 Boylston Street Jamaica Plain	1 story mixed	owner (assumed) (Bill's Auto Service)	occupied	fair	not known

Fig. VI-13 (con't)

Address	Type of Structure	Estimated Tenure	Estimated Vacancy	General Condition	Assessed Value of Property, 1974
(95) Mozart Street Jamaica Plain	1 story concrete block	owner (assumed) (garage spaces)	not known	fair	not known
76 Atherton Street Jamaica Plain	Partial taking of 1 story metal sheds on publicly owned land	owner (Colour-picture Publishers, Inc.) Note: sheds are on land leased from MDC & MBTA	occupied	good	n.a.
3805-3811 Washington St. Jamaica Plain	four structures	owner (Davis Monumental Works, Inc.)	occupied	good	9,500
3819 Washington Street	Partial Taking: access changes	owner (assumed) (Fruit Stand)	occupied	good	2,000
3825 Washington Street (see Note 2)	Partial Taking: access changes	owner (Kehian Real Estate)	occupied	good	4,000
400 Arborway Jamaica Plain	1 story brick	owner (American Legion Post #76)	occupied	good	n.a.
19 Bartlett Square Jamaica Plain	Partial Taking: railroad spur and access road	owner (American Cellophane & Plastic Films Corp.)	occupied	--	230,400
18 Bartlett Square	Partial Taking: access only (PHP-2 only)	owner (Hanson Contracting Co.)	occupied	good	14,300

Fig. VI-13 (con't)

Address	Type of Structure	Estimated Tenure	Estimated Vacancy	General Condition	Assessed Value of Property, 1974
420 Amory Street Jamaica Plain	small shed (PHP-2 only)	owner (assumed) (AAA Auto Parts Parts)	occupied	fair	3,800
267 Amory Street Jamaica Plain	several 1 story frame & concrete block structures (PHP-2 only)	owner (J & M Brown Co., Inc)	occupied	good	13,000
1407-1419 Tremont St. Roxbury	1 story brick	renters (La Casa Alegre; Able T.V.; Stony Brook Tavern, Inc.; Athena Market)	4 occupied 2 vacant	good	25,000
1414-1420 Tremont St.	4 story brick	renters (Discount Tire Mart; Cardarelli & Sons, Roofers)	occupied	good	8,200
1424 Tremont Street	4 story brick	renter (Parker Hill-Fenway Neighborhood Employment Center)	occupied	good	14,600
131 Green Street Jamaica Plain	Partial Taking: access changes	owner (Kilgarriff's Cafe Inc.)	occupied	good	12,000

Fig. VI-13 (con't)

Address	Type of Structure	Estimated Tenure	Estimated Vacancy	General Condition	Assessed Value of Property, 197
1414-1420 Tremont St.	4 story brick	renters (Discount Tire Mart; Cardar-elli & Sons, Roofers)	occupied	good	8,200
1424 Tremont Street	4 story brick	renter (Parker Hill-Fenway Neighbor-hood Employment Center)	occupied	good	14,600
131 Green Street Jamaica Plain	Partial Taking: access changes	owner (Kil-garriff's Cafe, Inc.)	occupied	good	12,000
3529 Washington Street Jamaica Plain	Partial Taking: access changes	renter (assumed) (Kinney Vacuum)	used	--	n.a.
361 Washington Street Jamaica Plain	Partial Taking: access changes (PHP-2 only)	owner (assumed) (Jenney Oil Co.)	vacant	--	n.a

Source: Field Survey, City Directory

Note 1: Same structure as residential structure at 256 Columbus Avenue

Note 2: Same structure as residential structure at 3825 Washington Street

(FIG. VI-14)

SUMMARY OF PROPERTIES TO BE TAKEN: RESIDENTIAL
POST HEARING ALTERNATIVES PHP-1 & 2

	Structure by Structure Type				
	1F*	2F	3F	4F+	Total
South End					
No. of Structures			2	3	5
Owner occupied units			2	0	2
Renter occupied units			4	39	43
Total units			6	39	45
Jamaica Plain					
No. of Structures	2	3	1	1	7
Owner occupied units	1	2	1	0	4
Renter occupied units	1	4	2	6	13
Total units	2	6	3	6	17
Total Takings					
No. of Structures	2	3	3	4	12
Owner occupied units	1	2	3	0	6
Renter occupied units	1	4	6	45	56
Total units	2	6	9	45	62

Source: Field Survey, Assessment Records, City Listing

*One family, etc.

(FIG. VI-15)

PROPERTIES AFFECTED BY VARIOUS ALTERNATIVES

Address	Alternatives								
	SC-1	SC-2	FH-1	FH-2	FH-3	FH-4	FH-5/6	PHP-1	PHP-2
Residential									
18 St. Charles St.	F							F	F
20 St. Charles St.	F							F	F
20 Cazenove St.	F							F	F
26 Cazenove St.	F							F	F
256 Columbus Ave.	F	F						F	F
3834-3836 Washington Street			F	F			F	F	F
117 McBride St.							F	F	F
123 McBride St.							F	F	F
135 Carolina Ave.							R		
137 Carolina Ave.							R		
140 Carolina Ave.							R		
142 Carolina Ave.							F	F	F
165 Green St.							R		
90 Mozart St.							R		
129-131 Boylston							F	F	F
133-135 Boylston							F	F	F
301-303 Highland							F	F	F
Structures Affected	5	1							
Housing Units	45	7							
Structures Affected			1	1	0	0	12		
Housing Units			2	2	0	0	24		
Structures Affected								7	7
Housing Units								17	17

F = full

R = raise or relocate building

[illegible]

Fig. VI-15 (con't)

Address	Alternatives									
	SC-1	SC-2	FH-1	FH-2	FH-3	FH-4	FH-5	FH-6	PHP-1	PHP-2
<u>Business</u>										
95 Berkeley St.	P								P	
90 Berkeley St.	F								F	
254-256 Columbus	F	F							F	F
258-260 Columbus	F	F							F	F
262-264 Columbus	F	F							F	F
75 Clarendon St.	P								P	
238 St. Botolph	P								P	
Adj. 6 Gainsborough St.	P								P	
3805-3811 Washington St.			F	F	F	F	F	F	F	F
3819 Washington			P	P			P	P	P	P
3825 Washington			P	P			P	P	P	P
400 Arborway			F	F	F	F	F	F	F	F
19 Bartlett Sq.			P	P	P	P	P	P	P	P
18 Bartlett Sq.				P			P			P
420 Amory St.				F			F			F
267 Amory St.				F			F			F
41 Amory St.				P		P	P			P
Ruggles St/Columb.				F		F	F	F	F	F
Ruggles St/Forsyth				P		P	P	P	P	P
154-160 Green St.							F	F	F	F
Adj. 352 Amory							F	F		
109 Lamartine St.							F	F	F	F
126 Boylston St.							F	F	F	F
95 Mozart St.							F	F	F	F
76 Atherton St.							P	P	P	P
1407-1419 Tremont							F	F	F	F
1414-1420 Tremont							F	F	F	F
1424 Tremont							F	F	F	F
131 Green St.							P	P	P	P
3529 Washington							P	P	P	P
3651 Washington							P			P
38 New Heath St.									P	P
41 New Heath St.									P	P
166 Terrace St.									P	P
Properties Affected	8	3								
Businesses Affected	7	2								
Businesses Displaced	3	2								
Properties Affected			7	11	5	6	23	18		
Businesses Affected			7	11	5	6	29	24		
Businesses Displaced			3	5	3	3	19	17		
Properties Affected									28	33
Businesses Affected									33	38
Businesses Displaced									19	21

F = full
P = partial

CHAPTER SEVEN:
RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7.0 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Previous actions in the corridor affect the current assessment of short and long-term benefits and costs. These actions, based on earlier plans to construct the Southwest Expressway (1-95 South) in the taking of lands north of Forest Hills and the clearance of virtually all of the structures occupying the proposed right-of-way for the expressway. The takings have been accomplished; one principal long-term price has already been paid. However, analysis of the proposal for a Relocated Orange Line has exposed the fact that new long-term development can reverse many of the impacts which have already occurred, and which can open up possibilities for long-range benefits which were not possible with the original expressway plans. The concurrent development of the proposed Relocated Orange Line, its related access facilities, and an intensive land development program in the Corridor leads toward a final product which can produce a net benefit for the Corridor neighborhoods and the region.

Alternatives have been developed with long-term benefits in mind, as well as considerations of how they would address detrimental impacts already caused by previous actions in the Corridor. This approach focused principally on the clearance that has already occurred and the short-term impact of uncertainty and time delay before a final decision was made on the program for transportation improvements.

The analysis of the relocated Orange Line project has addressed the potential for both short and long-term costs and benefits (See Sections 5 and 6). Possible short-term effects and their relationship to the maintenance and enhancement of long term productivity are discussed in the following text. These include questions of land acquisition, construction phasing and traffic patterns, and the economic effects of construction investment. Issues concerned with the longer-term productivity of the project include transport benefit, land development, flexibility for future transit services, and environmental enhancement through regional paths and open space.

7.1 Land Acquisition

The major clearance which occurred in the Penn Central corridor north of Forest Hills has negatively affected both public and private renewal in the adjacent communities. Takings and demolition, coupled with delay and indecision, have contributed to a sense of a downgraded community. The reversal of this negative trend is clearly a community objective which must be implemented as part of the decisions regarding development in the Corridor. A clear public purpose is to make the Corridor environment into a public asset rather than a liability.

The proposed project offers the advantage of not requiring the further large scale, short-term impacts of land acquisition which would have been necessary in an expressway project. Parcels near Back Bay Station will be necessary for right-of-way modifications under the proposed alternatives for construction of the rail/transit facilities including the new station. Some presently vacant land in Roxbury is required for all alternatives for the construction of the Relocated Orange Line and the railroad. Additional parcels are required in the modified embankment and depressed alternatives for construction of the Relocated Orange Line, the railroad, and the Arterial Street in Jamaica Plain.

Under the Modified Depressed Alternatives (Alt. FH-5), the Relocated Orange Line and the railroad tracks are placed high enough as to be not affected by the existing ground water. This arrangement, inturn, requires that the arterial street to the east from Ruggles Street to Forest Hills, and all the local streets in between crossing over the depressed tracks, be raised in order to obtain the required vertical clearance. The result is that streets such as Ruggles, Tremont, Heath (and Highland), Center, Mozart (Atherton), Boylston, Green, Williams and

McBride, would be raised approximately 12 feet, and private properties along these streets will be affected. The Post-Hearing Profile dips below the water table at certain key cross streets and the amount that those streets vary is between 4 and 12 feet.

The private properties affected by the raised local streets in the Modified Depressed Alternatives, approximately seventy in total, would for the most part be able to remain with modifications to their accessways and entries. This number is reduced by approximately 20 in the Post-Hearing Alternative. Construction easements and/or damages would be necessary. Proper designs in landscaping and architecture would be employed to minimize adverse visual impact and to maintain neighborhood integrity in the area.

This project does not use all of the land already acquired or to be acquired for the rail/transit and arterial street facilities. It offers the opportunity to use excess acquired land for community development. This would provide the opportunity to off-set some previous damage to the community and to create long-term economic, physical and social benefits for the Southwest Corridor.

7.2 Economic Effects of Construction Investment

Figure VII-1 summarizes the benefits derived from investment in the construction of the Southwest Corridor project.

To assist in reading the economic chart, the following sequential development of numbers for the "Post-Hearing Depressed Rail/Transit, No Arterial Street South of Jackson Square - with minimum grade adjustment to all tracks" Alternative is presented as a sample exercise.

Construction Jobs - Man Years

A construction project of this type generates an estimated 36 man years of labor per million dollars in construction expenditure.

Construction Expenditure	= $305.3	Million
Man Years of Labor	= 36 per	Million
$242.3 Million x 36	= 10990.8	Say 11000 Man Years

Construction Jobs - Average Annual Man Years

The average annual man years of labor is derived by dividing the total man years by the estimated duration of construction as set forth in Fig. V-13.

Man Years	= 11000	
Construction Duration (Years)	= 4	
11000 Man Years ÷ 4 years	= 2750	Say 2750 Aver. Annual Man Years

Construction Impact
Average Annual Payroll ($Million)

The average annual payroll is a function of the average annual man years multiplied by an estimated annual wage of $12,500.

Aver. Annual Man Years	= 2750
Aver. Annual Wage	= $12,500
2180 x $12,500	= $34.4 Million Aver. Annual Payroll

Construction Impact
Multiplier Effect on Economy ($Million)

The multiplier effect on local and regional economy can conservatively be estimated to be 1.4 times the average annual payroll.

Aver. Annual Payroll	= $34.4 Million
Multiplier	= 1.4
27.2 Million x 1.4	= $48.1 Million

The location of the proposed construction work and permanent facilities within the City of Boston will provide incentives to local economic development in a manner consistent with the Governor of the Commonwealth's policy of investment in urban areas.

MBTA expects to utilize the Commonwealth's affirmative action plans in the execution of its construction contracts in the Southwest Corridor. These will insure that significant numbers of jobs are filled by minority group members. Two existing projects, one already underway and the other in bid document preparation, now utilize two existing affirmative action plans.

The first of these is the Commonwealth's "Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Program", the so-called Altshuler plan. This plan requires that the construction contractor insure that 30% of all jobs, trade by trade, be filled by minority group members when such jobs are in the "30%" impacted area; the plan has specific monitoring methods and sanctions which may be imposed for non-compliance.

The second such plan is the MBTA's Minority Contractor Participation Plan, a minority contractor set aside, which requires that 30% of the total dollar amount of certain contracts be with minority contractors.

It is the Authority's intention that these plans, or their successor plans, be implemented on the Southwest Corridor project segments within the impacted areas.

Requests for changes in such proportions have been and will be directed to the Secretary of Transportation and the Governor of the Commonwealth of Massachusetts for their policy advice.

Likewise, requests for residency requirements or preferences voiced during the Public Hearing will be directed to these officials.

7.3 Transportation Service

Construction of the transit facility in the existing and improved railroad Mainline Corridor results in improved overall transit service to the Corridor, and to the regional transit network. The addition of South End and Roxbury services and ultimately the circumferential transit line will create a public network which will provide an even higher level of transportation service.

Construction of the Relocated Orange Line will take place in an existing transportation corridor, so that there will be no major impacts in the introduction of a transportation element in densely populated urban environment. The capital investment in the Relocated Orange Line will be somewhat greater if the Orange Line and railroad facilities are depressed. This investment will not produce proportional transportation service improvements, but will allow for long-term future flexibility for both public transportation (both rapid transit and railroad) and for development with reduced environmental impact.

The purpose of this capital investment for both the short and long-term would be to eliminate the principal environmental degradation which would be caused by the air, noise, community division and visual impacts which would result from the retention of the embankment particularly under conditions of increased commuter rail and AMTRAK service. This investment is not one which can be deferred. If the line is to be depressed, the action must be taken in the initial construction period. Later removal of the embankment may not be possible due to the potential for disruption to existing service and the land use which may exist in the future. Further, it is imperative that this land development be undertaken as soon as possible.

7.4 Land Development Opportunities

The Southwest Corridor Staff and various local planning agencies have worked for several years with residents, business men, and neighborhood organizations to identify local land development needs and goals. Work has also been done with environmental groups and agencies in order to see how the Southwest Corridor might help fulfill regional open space needs. A principal goal of the project is the physical and economic development of Corridor neighborhoods.

Joint-development of transportation facilities with new housing, commercial, industrial, and open space facilities are an integral part of this work. Without transportation development that is coordinated and environmentally appropriate, new development will be seriously hampered and neighborhoods will not improve. With proper consideration, the transportation facilities will generate desirable development.

Some of the results of this work have been published in the following three reports:

1 - Southwest Draft Environmental Impact Statement, Preliminary Location Report and Program Package Evaluation Report; Boston Transportation Planning Review; September 1972.

2 - Southwest Development Report, Southwest Corridor Development Coordinator, Summer 1974.

3 - Land Development in the Southwest Corridor from the Southeast Expressway at Massachusetts Avenue to Jackson Square; Housing Innovations, Inc., September 1974.

Because of the very open and participatory nature of the planning process, land development plans have evolved gradually as neighborhood's goals and alternatives become more focused. Some of the plans are very firm and are already being implemented. Others are flexible and must contain contingencies in cases where development on the land in question requires the impetus of new transportation facilities in order to become feasible.

A basic factor in real estate development is that of certainty. Until transportation elements are clearly fixed with strong commitments for implementation and construction, development is retarded. This certainty would occur upon approval of the transportation project, and concrete development plans could then move further forward.

The goals and principles upon which the land development planning process is based can be identified, as can the specific opportunities that exist in the neighborhoods and in the Corridor as a whole.

7.4.1 Goals and Principles

1 - To improve the physical character of neighborhoods that have suffered from highway right-of-way acquisition. To prevent further deterioration of neighborhood stability.

2 - To encourage development and construction of a nature that will strengthen the economic base of the communities adjacent to the transportation improvements.

3 - To provide joint development of a nature that will strengthen and reinforce transit use.

4 - To encourage development of a nature that will generate jobs for residents of the communities adjacent to the transportation improvements.

5 - To be sure that public transportation improvements, including the Relocated Orange Line, railroad improvements, and local surface transportation are provided in such a manner as to promote and strengthen land development as well as existing uses.

6 - To promote continuous, cooperative planning among residents, agencies, business people, local government and interested private organizations. The aim of planning is to achieve a consensus on a plan and construction on the cleared land area not required for transportation purposes. This includes identifying needed public improvements on DPW land and their implementation. Among the needs are: improvements in public transportation, establishment of permanent open space and recreation areas, other public facility improvements, and housing, commercial and industrial facilities.

7 - To identify and implement acceptable temporary uses for Corridor land that is not developable within 5 years.

8 - To identify and use other possible sources of support - both public and private - for agreed-upon goals.

7.4.2 Land Development Plan

The development plan which is presented in this section was prepared with the objective of providing public and private land development opportunities which could produce the maximum benefit to adjacent neighborhoods. The alignments of the transportation elements which create development parcels have been selected with the objective of providing service and access to adjacent neighborhoods with the minimum possible adverse impact upon those neighborhoods. The plan has incorporated the suggestions which arose at public presentations of the alternate plans for alignments and land use whenever possible.

7.4.3 Development Parcels

7.4.3.1 Development Parcels - Jamaica Plain

Land development in Jamaica Plain considers vacant land and DPW owned structures in the Corridor from the area of the existing pedestrian bridge near Walk Hill Street to Jackson Square. Clearance had been partially completed in this area at the time work was stopped on I-95. As a result, the pattern of cleared land is somewhat disjointed leaving a variety of conditions. Discussion of impacts of the eight construction alternatives will, for the sake of clarity, be more general in Section 7.4.5., Development Potential which will quantify the proposed uses for each land parcel.

Forest Hills area south and west of station.

Parcels 1 through 12 (There is no "Fully Depressed" alternative in this segment)

Existing Land Use: The surrounding area is primarily residential with some small scale retail and manufacturing on major thoroughfares. Major nearby uses are the Arnold Arboretum to the west and the Forest Hills retail area to the northeast. Some of Parcels 1 through 12 are presently in use for MBTA purposes, and for small scale retail and residential purposes.

Existing Zoning: M-1, I-2, L-5, R-5, R-8

Topography: Flat along Washington Street, rising moderately to the east, west, and northwest. Stony Brook Conduit runs through this area and encloses the former stream which ran approximately where Washington Street is today. Existing railroad embankments are major topographic features.

Proposed Uses:

Parcel 1: Auto-oriented commercial.

Parcel 2: Lumberyard and existing houses should be returned to private ownership.

Parcel 3: Existing houses should be returned to private ownership.

Parcel 4: Two family house and open space.

Parcel 5: Commercial or manufacturing.

Parcel 6, 7, & 8

For All Depressed Alternatives:
These could combine to create a sizable commercial opportunity. Otherwise, special access provisions could be made to allow houses on parcel 7 to remain. In this case parcels 6 and 8 would be sold to abutters for private use.

For Embanked Alternatives: Parcel 7 would not be acquired. Parcel 6 could be sold to an abutter for private use. Parcel 8 could revert to Davis Monument Company if there is still sufficient land area after Washington Street re-alignment. Otherwise, parcel 8 could be used for commercial purposes.

Parcel 9: Fill should be placed against steep slope to stop erosion. Some auto-oriented commercial could occur along new Washington Street frontage. Balance of land not needed for Orange Line and Green Line yards should be sold to abutting homeowners to expand rear yards; control existing erosion through fill and walls.

Parcel 10: Existing house at 8 Asticou Road to be sold for private residential use.

Parcel 11: Mixed retail, office and housing. Should be designed to smooth the transition from station complex to residential neighborhood.

Parcel 12: Open Space bikeway, regional pathway. Should remain open and public as part of open space linkage. It is suggested that some of the State Public Health Laboratory land could be used to complete the linkage to the Arnold Arboretum.

Impacts of Transportation Alternatives on Parcels

Parcel 1 is more easily developed with the Depressed alternatives since the rail elevation is below the grade of the site. Parcels 2 and 3 will not be materially affected by the rail elevation. Easier pedestrian crossing of the corridor would enhance these parcels as well as others in the area.

For the Depressed alternatives Washington Street must be raised enough to meet the cross street to Hyde Park Avenue. This means that parcels 4, 6, 7, 8 and 9 must be filled sufficiently to meet the new street grade. For the Embankment alternative filling would not be required and parcel 7 and part of parcel 4 would not have to be taken.

The Depressed alternatives with its corresponding rise of Washington Street makes parcels 10, 11 and 12 more attractive for development because of less severe grades and a more attractive outlook to the east.

Long Range Impact of Transportation Alternatives

For the Depressed alternatives it would be possible to merge parcels 1, 2, 3 and 4 plus air rights over the tracks to create a site for a reasonably sized

medium density market rate housing development which would make off-hours use of station parking and would benefit the local retail area. The station area and neighborhood in general would benefit from the increased 24 hour population and from the reduction in unoccupied areas during off-hours. A pedestrian passage could link this complex directly into the station area without crossing streets.

For the Depressed alternatives it would be possible to merge parcels 6, 7, 8 and 9 plus air rights over the Needham Branch tracks and Green Line yards to create a site for a market rate housing development, or for recreational use. Open space to the southwest between the Needham tracks and South Street could give this development a very pleasant environment.

If further study shows such developments to be a desirable possibility, then it is recommended that the land parcels involved be leased for temporary uses until the future air rights project becomes feasible.

Forest Hills Station and area to immediate north and east

Parcels 13 through 18

Existing Land Use: Apart from existing transportation facilities the area is predominantly in retail use and uncontrolled land use for parking. Nearby uses are the Arnold Arboretum to the west, the Arborway MBTA yards to the northeast and Franklin Park and Forest Hills Cemetery farther to the east.

Existing Zoning: L-5

Topography: Essentially flat except for the existing grade changes to be accomplished within the proposed new station (see architectural drawings). The William J. Casey highway overpass (connecting Arborway and Morton Street) is a structure of much height and length that it should be regarded as a major topographical feature.

Proposed Uses: (There is no "Fully Depressed" alternative in this area)

Parcel 13: All Depressed alternatives: Local neighborhood and auto-oriented retail. Has frontage on a busy street and faces an established retail area.

Parcel 14: All alternatives: Convenience and impulse retail. Frontage on a pedestrian path between buses, parking garage, and trains.

Parcel 15: All Depressed alternatives: and open space surrounding station head house and forming part of linkage between Arboretum and Franklin Park.

Embanked alternatives: Plaza and open space. Part of area below tracks could

be enclosed for retail use, although this is less attractive because of railroad and transit bridge overhead.

Parcel 16: Mixed uses including retail, office, hotel, housing and commercial parking. With embanked alternative and no Orange Line extension to Needham, the parking demand and impact may be such that this site will have to be used for a publicly owned parking structure.

Parcels 17 and 18:

Open space and possible site for municipal uses. City DPW yard could be moved to parcel 18 under the viaduct, removing an eyesore from the entrance to Franklin Park and enhancing the open space linkage to the park from the Corridor.

Impacts of Transportation Alternatives on Parcels

Parcel 13 is not available with the station designs for the Embanked alternatives. With the Depressed alternatives parcel 14 becomes larger and gains frontage on the plaza, parcel 15.

Parcel 15 contains some retail space with the Embankment alternatives, however the parcel is less attractive for open space since it is lower and it must pass under the tracks.

Parcel 16X is relatively unaffected by the transportation alternatives unless a combination of circumstances forces the later taking of this parcel for parking purposes. In this case, most development potential would be lost.

Parcel 17 and 18 are reduced slightly in area for the "no-build Jamaica Plain arterial" alternatives.

Long Range Impact of Transportation Alternatives

With the Depressed alternatives it may be possible to complete an auto-free pedestrian linkage from the Arboretum to Franklin Park and northward along the corridor. This is not possible in the Embanked alternatives because the increased bulk of that structure will block the grade separated pedestrian right-of-way.

Arborway to Hall Street

Parcels 19X through 26

Existing Land Use: These parcels are situated in an area whose uses have been predominantly manufacturing and transportation-related. Immediately adjacent are residential neighborhoods of medium density. Morton Street and the William J. Casey highway overpass lie to the south.

Existing Zoning: R-8 and M-1

Topography: Relatively low and flat with some higher undulations to the west of the existing rail embankment.

Proposed Uses:

Parcel 19X: This is the present site of the MBTA Arborway yards and headquarters office. A capital grant application has been submitted to substantially upgrade the bus storage and maintenance facilities.

The proposed Forest Hills Station complex anticipates a relocated Green Line terminus and anticipiates relocation of storage yards to the southwest paralleling the Needham Branch right of way. These changes should permit a proposed wider greenbelt strip along the south side of the site. In addition, it is suggested that the southwest corner of the site be made available in the future for commercial development. An area of approximately 20,000 square feet is suggested although this might increase depending on land availability and market condtions.

Parcel 20X: No Arterial: Combined with parcels 21X and 22 to form a parcel with an area of approximately 69,000 square feet. This could be developed for additional oil storage facilities (parcels 20X and 21X are presently owned by Jenney Oil) or it could be developed for commercial use.

Arterial: Could be combined with surplus land from parcel 19X to create a parcel of about 40,000 square feet. Proposed use is commercial or retail.

Parcel 21X: No Arterial: Combined with 20X.

Arterial: Location is highly visible and commercially marketable at bend in realigned Washington Street. Retail use is proposed if land is not needed for oil storage operations.

Parcel 22: No Arterial: Combined with 20X.

Arterial: This is a very high visibility corner. Proposed use is commercial or retail.

Parcel 23: No Arterial and Embanked with Arterial: Sell to abutters for industrial use.

Depressed Alternatives, Arterial East: Very little land area remains, merge into greenbelt system.

Parcel 24: Possible relocation site for American Legion Hall to be moved from adjacent site. Could also be used for retail or commercial.

Parcel 25: Small parcel remaining after connection is made between St. Marks and Anson Streets. Proposed use is parking for Fordham Court apartments and one house lot for a new one to three family house.

Parcel 26: Housing and open space.

Impacts of Transportation Alternatives on Parcels

Depression of the rail facilities will make these parcels more developable because of improved environment and removal of the embankment slopes. Open space would also be more attractive and usable.

Construction of the arterial street would consume some land area, however in the Depressed, Modified and Post-Hearing alternatives most of this would come out of parcel 23 which has poor access and is not likely to be developed in a way which would create large benefits. The arterial would divide the large parcel at the Washington Street/Morton Street corner.

Long Range Impact of Transportation Alternatives

With the Depressed Alternatives it would eventually be possible to build on air rights over the tracks. This could take the form of office or housing development at Forest Hills and housing between parcels 23 and 26.

Hall Street to Sumner Hill

Parcels 27X to 45

Existing Land Use: Predominantly industrial to the east of present rail embankment and predominantly residential to the west.

Existing Zoning: R-8, M-1, M-2

Topography: Fairly flat, rising somewhat towards Sumner Hill to the northwest.

Proposed Uses:

Parcel 27X: Housing. Grouped with parcels 29 and 30 and possibly 26.

Parcel 28: Embankment with no Arterial: Suitable for small open space uses.

All other alternatives: Very small - incorporate into greenbelt system.

Parcel 29: Housing.

Parcel 30: Sell two houses currently standing or could clear for new housing.

Parcel 31: Sell to abutter or sell to owner of adjacent lot.

Parcel 32: Housing. Site for a new one to three family house.

Parcel 33: Housing. Site for a new one family house.

Parcel 34: Housing-related. Sell to abutters for expanded backyards.

Parcel 35 & 36:

No Arterial: Open space or housing. Housing could be low to medium density detached or multi-family.

Arterial: Open space.

Parcel 37: Depressed and Modified Depressed: Potential future decked area. Housing or open space related to high school. With decking installed parcels 35 and 37 can be aggregated. If arterial is not built, parcels 35, 37 and 38 can be aggregated.

Post-Hearing Alternative: Deck is included for pedestrian circulation and open space related to High School.

Embankment: Not feasible for development of any kind.

Parcel 38: Leftover strip adjacent to high school. Transfer to high school for open space. For Depressed Alternatives, no Arterial only: With air rights construction, (parcel 37) parcels can be aggregated for housing or for a unified public open space.

Parcel 39: Sell to abutters: southern end to high school, northern end to cellophane factory.

Parcel 40X & 41X:

Site of new Southwest II Jamaica Plain High School. Much of the site area will be athletic fields and open space accessible to neighborhood.

Parcel 42: No Arterial: Should be offered to City for possible safety improvements of Call Street/Everett Street corner.

Arterial: Open space (merged with parcel 36), and expansion of lot area for houses on parcels 43X and 44.

Parcels 43X and 44:

Embanked, No Arterial: Continue in present configurations.

Depressed Alternatives:
Continue in present use after revising shapes of lots.

Embanked, Arterial West: Analyze noise impact. Treat structures acoustically or remove them and attach remaining land to parcel 45.

Parcel 45: Housing or open space. Standing house at 22 Everett Street could be sold. Balance of site could be housing if subsoil conditions permit construction. Alternative use is open space, possibly with a sitting area for the numerous elderly residents of the neighborhood.

Impacts of Transportation Alternatives on Parcels

Full Depressed and Modified Depressed alternatives are beneficial to the future high school on parcel 40X in that they help mask the visual and noise problem. They enhance the utility of parcels 35 through 39. The opportunity to add bridges or decking over the tracks at a later date greatly benefits the future flexibility of the high school. This deck is provided in the Post-Hearing Alternative.

The modified depressed alternatives are an improvement over present conditions in terms of noise and visual impact, however they are not quite as beneficial as fully depressed. McBride and Williams streets must be raised, creating a 3 to 5% slope in Williams and McBride streets in order to get up and over the rail facility. Since the arterial street must be raised also at these intersections its noise impact is potentially more severe on the high school though proper design of this new facility would eliminate the problem within the building. Streets will boarder the high school site on three sides with slopes toward the rail facility. The covering of the rail right-of-way in this area in the Post-Hearing Alternative improves conditions dramatically.

The Embanked alternatives worsen the present conditions visually but streets would remain as is. If the arterial street were to be located on the west side of the embankment, its impact on the high school will be reduced, but its impact on the open spaces will be greater. The extra right-of-way width reduces the area and usable width of parcels 35, 36 and 45.

For the Modified Depressed alternatives, the raised cross streets and the related raising of Call Street will affect several properties and the neighborhood to a limited degree. It will not have the same sense of wide open connection with the high school's open space as with the other depressed alternatives, but will dramatically improve visual access across the tracks with most of the trees and the rehabilitated high school structure almost entirely visible from the west (see Section 6.7 Adverse Visual Impacts). Landscaped slopes will gradually rise from existing grade to the new facility.

The Post-Hearing alternatives will greatly improve visual and pedestrian access over the No-Build transit and Embanked alternatives. They also permit the provision of longer auto-free bikeways and trails than in any other alternatives.

The Arterial alternatives will benefit the high school by providing better vehicular access, but will limit the view more than in the No-Build street alternative. Pedestrian access from Green Street Station will be more secure also in the Build-Arterial option.

Long Range Impacts of Transporation Alternatives on Parcels

The Depressed Alternatives would permit significant aggregation of land parcels between McBride Street and the corner of Call Street and Everett Street. Parcel 45 could eventually be expanded through air rights development.

Green Street Station Area

Parcels 46 through 53

Existing Land Use: Largely vacant except for a contractor's office and an auto wrecking yard. Former uses were commercial and residential.

Existing Zoning: R-8, L-1, M-1

Topography: Flat east of present embankment. Hilly and slopes upward to the west of the embankment.

Proposed Uses:

Parcel 46: Retail and housing.

Parcel 47: (alternate 4 only) Retail and housing.

Parcel 48: Retail incorporated in station design.

Parcel 49X: Retail or commercial.

Parcel 50: (Modified or Post-Hearing with Arterial) Could be open space or retail with open space. Brings open space network to east side of tracks and arterial.

Parcel 51: Transfer to adjacent owner or use as open space.

Parcel 52: Open Space. Expands Johnson Playground.

Parcel 53: Open Space. Wide enough for some active uses with No Arterial and Modified Depressed or Fully Depressed Alternatives.

Impact of Transportation Alternatives on Parcels

Depressed alternatives permit visual linkage of parcels 52 and 53 greatly enchancing the sense of openness. Modified Depressed and Post-Hearing No Arterial also will have this effect.

The Embankment alternatives reduce the usability and attractiveness of parcels 52 and 53 because of the slopes and the visual separation.

The Modified Depressed alternatives require Green Street to be raised about 12 feet from existing grade with new ground slopes up to it. This, in turn, affects several adjacent properties that would be regarded. Slopes require that new development be designed accordingly. This has been reduced to 6 feet in the Post-Hearing Profile making a nearly level (2 ft. rise) connection from the west.

Long Range Impacts of Transportation Alternatives on Parcels

The Depressed, No-Arterial alternatives would permit the eventual merger of parcels 52 and 53. This would permit expansion of usable open space or alternatively would permit air rights development, perhaps for housing.

Minton Street to Boylston Street

Parcels 54 through 58X

Existing Land Use: Vacant and open space formerly residential.

Existing Zoning: R-8, L-5, L-1, M-1

Topography: Flat except for embankment slopes

Proposed Uses:

Parcel 55: Arterial Alternatives: Oakdale Street is rebuilt creating a lot for a one to three family house.

No Arterial: Land merges into parcel 52 (open space)

Parcel 54 & 56:

Open space.

Parcel 57: Open space except under and Post-Hearing Alternatives and Fully Depressed, No Arterial. In these cases, there is sufficient land area for small retail and residential development.

Parcel 75X: Could be joined with parcel 57 to complete connection to Amory Street.

Parcel 58X: Has no access. Should be incorporated into open space or sold to abutting houses on Amory Street.

An open-space and recreational deck is included in the Post-Hearing Alternative between Oakdale Street and Lorene Place. This deck significantly improves pedestrian circulation and safety across the rail/transit depression particularly for access to our Lady of Lourdes School and the Jamaica Plain Neighborhood House.

Impacts of Transportation Alternatives on Parcels

All the Depressed Alternatives will greatly improve the usability and attractiveness of the open spaces. The apparent size of the open space will also be much greater.

The Embankment, Arterial west severely impacts parcel 56 and reduces its usefulness.

Modified Depressed, Arterial will create a visual barrier between parcels 54 and 56, reducing the sense of openness.

Long Range Impacts of Transportation Alternatives on Parcels

The Depressed Alternatives would permit eventual decking and substantial expansion of available open space. Residential or commercial development might occur over the tracks near Boylston Street.

Boylston Station Area

Parcels 59 through 64

Existing Land Use: Vacant and open space. Formerly retail, residential and industrial.

Existing Zoning: L-1, M-1, M-2.

Topography: Relatively flat, rising gently to the west and east.

Proposed Uses:

Parcel 59: Retail incorporated in station design.

Parcel 60X: Retail and housing.

Parcel 61: Retail. Difficulty of developing this small parcel suggests that it be combined with adjacent parcels to achieve a more substantial new development, possibly encompassing the entire block.

Parcel 62X: Housing, institutional or commercial. All three uses are adjacent, permitting this range of choices.

Parcel 63: No Arterial: Open Space.

Arterial: Lamartine Street is closed in this area permitting merger with parcel 62X and consequent expansion of its housing, institutional or commercial development. An open space strip should be maintained to accomodate the open space linkage system.

Parcel 64: Fully Depressed Alternative: Will remain visible and should be maintained as open space. Stony Brook Conduit prevents construction.

Modified and Post-Hearing Alternatives: The raising of Boylston Steet will require the grading of the parcel and will make it suitable for passive landscape use.

Embanked Alternatives: Could be sold off to adjacent industries for minor expansion, outdoor storage or parking.

Impacts of Transportation Alternatives on Parcels

All the Depressed Alternatives will enchance the apparent size and usability of open spaces. Reduced environmental impacts would increase the development potential of parcels 60X, 61X and 62X.

The Arterial Street, Embanked Alternative will enhance the retail potential of parcels 60X and 61X.

The Depressed and Modified Depressed Arterial East will permit interruption of Lamartine Street traffic, thereby improving parcels 62X and 63. This would improve their usability for residential or institutional purposes.

The Modified and Post-Hearing Alternatives require the raising of Boylston and Atherton Streets. This will affect several properties in the area and requires accommodation in new development.

Long Range Impacts of Transportation Alternatives on Parcels

All the Depressed Alternatives would permit future decking or air rights development over the tracks to the north of Boylston Street Station. This would permit expansion of parcel 63 for open space or development potential. If the arterial is not built, parcels 63 and 64 and the future air rights area could combine to make a development parcel of substantial size.

Atherton Street to Jackson Square

Parcels 65 through 75X

Existing Land Use: Vacant, parking and auto dismantling yard. Formerly manufacturing and residential. Surrounding uses are largely residential with some retail and manufacturing.

Existing Zoning: M-1, M-2, M-4

Topography: Fairly flat, rising gently to the east and west of the embankment.

Proposed Uses:

Parcels 65, 66 & 67:

Depressed and Post-Hearing: Housing or commercial.

Modified Depressed and Embanked: Commercial

Parcel 68: No Arterial: Open space or housing related.

Arterial: Too small to develop. Merge into greenbelt.

Parcel 69: Open space, commercial or manufacturing. Should merge with parcel 71 if development is to occur.

Parcel 70X: Could be independently developed for commercial or manufacturing if arterial is not built, though the limited access will be a problem. Type of use should be coordinated with parcel 71 development. If an arterial is built, parcel 70X will be acquired and remainder merged into parcel 71.

Parcels 71 & 72:

Mixed use retail and commercial.

Parcels 73X & 74X:

Retail, housing, manufacturing. Uses should coordinate with type of development on Parcels 65, 66 and 67. Modified Depressed alternatives require taking and filling of parcel 74.

Parcel 75X: Manufacturing, public facilities, open space. This is the largest developable parcel in this part of the Corridor. Improved transit service will greatly enhance its development potential.

Impacts of Transportation Alternatives on Parcels

The fully Depressed and Post-Hearing alternatives permit housing development on parcels 65 through 67, whereas the Modified Depressed Embankment alternatives limit development to commercial.

Arterial street construction reduces the usable areas of parcels 68, 69 and 71, however it requires the taking of parcel 70X, thereby restoring some of the lost area. Arterial street construction also involves a partial closing of Amory Street, thereby permitting parcel 72 to be joined with parcel 71.

Long Range Impacts of Transportation Alternatives on Parcels

All Depressed rail facilities could eventually be decked over, thereby permitting parcels 65 through 74X to work together as a major development complex.

7.4.3.2 Development Parcels - Roxbury

Land development in Roxbury considers vacant land in the Corridor from the Carter Playground south to Jackson Square at Centre Street. This is the area that was subjected to the greatest amount of clearance for the Southwest Expressway and consequently contains a large amount of presently vacant land. It offers the greatest opportunity for new development.

There are eight basic transportation alternatives being considered for this portion of the Corridor (see Fig. IV-19):

FH-1 Transit/rail in depression - no-build street

FH-2 Transit/rail in depression - build street

FH-3 Transit/rail on modified embankment - no-build street

FH-4 Transit/rail on modified embankment - build street

FH-5 Transit/rail in modified depression; build street to Jackson Square; build street south of Jackson Square.

FH-6 Transit/rail in modified depression; build street to Jackson Square; no-build street south of Jackson Square.

PHP-1 Transit/rail in Post-Hearing profile; build street to Jackson Square; no-build street south of Jackson Square.

PHP-2 Transit/rail in Post-Hearing profile; build street to Jackson Square; build street south of Jackson Square.

The discussion of impacts of these alternatives will, for the sake of clarity, be more general than Section 7.4.5, "Development Potential" which will quantify the proposed uses for each land parcel.

Carter Playground to Ruggles Street

Parcels 16, 17, and 18

Existing Land Use: These parcels are situated in an area which had predominantly manufacturing uses until the buildings were demolished for road construction. To the east is Roxse Housing, Lower Roxbury Community Corporation Housing, Whittier Street Housing, and Francis deSales School and Church. To the west is Northeastern University, and Mission Hill Housing.

Existing Zoning: M-2 and H-2 (Northeastern).

Topography: Fairly flat, some filled land.

Proposed Uses:
Parcel 16: open space, community facility
Parcel 17: uses ancillary means to transit/rail station
Parcel 18 and 18b: major development location situated at the station for the Relocated Orange Line and the commuter rail line, and the juncture of a proposed cross town transit line and the intersection of two proposed arterial streets. These parcels are seen as having multiple use. They would contain a mixture of the following uses: Public facility, housing, office, retail, hotel, and/or institutional.

Impacts of Transportation Alternatives on Parcels 16, 17, and 18

This location will have excellent transportation access and is adjacent to a large aggregation of new and existing multi-family housing and to Northeastern University. It is also the Corridor location which experienced the maximum amount of clearance for the Southwest Expressway. For these reasons, major development has naturally been proposed here (parcel 18).

Under the "build street" alternatives a single large parcel is possible with the option to create air-rights development connecting to Northeastern University. However, the parcel is substantially reduced in buildability under the embanked alternatives: if the necessary bus loop is constructed under the rails and platforms, any development must be held back from the rails because of the noise generated and the difficulty of constructing air-rights over the already elevated platforms. Moreover, if the bus loop were not built under the tracks, the loop will consume about one-half of the available parcel. In the fully depressed alternatives, a simple air-rights crossing is allowed: in the Post-Hearing depressed alternatives the air-rights crossing occurs at less than one normal story height above grade when approached from the west and is at grade on the east. This small grade change can easily be accommodated in the new development.

Under the "no-build street" alternatives parcel 18 is divided longitudinally by existing Columbus Avenue into parcels 18 and 18b. Parcel 18 becomes significantly less developable due to the reduction in area, and the conditions stated above concerning the embanked or depressed alternatives also apply. Parcel 18b remains developable for retail use or housing; however, the critically important direct access to the transit/rail station is lost in this alternative. Both parcels are adversely affected by the loss of the land area that would be gained through the abandonment of the Columbus Avenue right-of-way.

Parcel 16 disappears under the "no-build street" alternatives.

Ruggles Street to Roxbury Crossing

Parcels 19 through 25

Existing Land Use: These parcels are situated in an area which had predominantly manufacturing uses until the buildings were demolished for previously proposed highway construction. To the east is the proposed Campus High School, and to the west, Mission Hill Extension Housing, and a strip of manufacturing establishments.

Existing Zoning: M-2 and H-1 (Mission Hill Extension).

Topography: Fairly flat, some filled land.

Proposed Uses:
Parcel 19: Addition of open space for Mission Hill Extension, regional trail and bikeway.
Parcel 20: Provision of open space for Mission Hill Extension, community facility, retail, housing.
Parcels 21 and 23: Open space, regional trail and bikeway.
Parcel 22: Provision of various facilities for the Campus High School and the Occupational Resource Center.

Parcel 25: Expansion of existing adjacent manufacturing uses or housing in the event that manufacturing does not continue to be a viable use in this area.

Impacts of Transportation Alternatives on Parcels 19 through 25

Under the transit/rail depressed alternatives open space is proposed to be provided on parcels 19 and 20 for Mission Hill Extension in conjunction with a proposed open-space deck over the transit/rail facility. Additionally, retail and/or housing, or a community facility is proposed for the northern (Ruggles Street) portion of parcel 20. The fully depressed alternatives allow a simple air-rights deck at grade; the modified depressed alternatives allow an air-rights deck approximately 8 feet high which can be approached by regrading at Mission Hill Extension and is approximately at grade on the arterial street or east side. If the embanked alternatives are constructed, the provision of additional open space for this dense housing becomes impossible and the existing housing will be subject to increased noise and the adverse visual impact of the embankment and would probably not pass the current noise guidelines for federally assisted housing. Parcel 25 and adjacent vacant land are being proposed for housing as a future use if manufacturing ceases to be a viable use in that location. Under the embanked alternatives this proposed housing would be subject to noise and the adverse visual impact of the embankment. Future development potential of parcels contiguous to the transit/rail right-of-way in the form of "air-rights" construction over the rails would be severely limited under the embanked alternative. The life of many structures to the west of the alignment is judged to be significantly less than that of the proposed transportation facility. When these areas become ready for redevelopment in the future, the potential of the land parcels will be greatly diminished due to the presence of an embankment. This comment applies particularly to parcels 21 and 25. The Fully Depressed and Post-Hearing alternatives allow simple air-rights structures at grade: the Modified Depressed alternatives allow air-rights structures one story above grade on the west and would be approximately at grade on the arterial street or east side. Parcel 25 would require filling, grading and retaining walls to allow a structure approximately at grade; these adjustments could easily be made in any new development after construction of the modified depression.

The "no-build street" alternatives in this portion of the Corridor, which would leave Columbus Avenue and Tremont Street in their present alignments leaves a long narrow parcel (parcel 22) between the rights-of-way. This parcel is too narrow in the most part for successful development for other than open space. The land gained by the relocation of Columbus Avenue is proposed to be added to the Campus High School and Occupational Resource Center site for construction of school facilities. The "no-build street" alternative makes impossible the enlargement of the High School site on a unified site and also loses the area for development that would result from the abandonment of the Tremont Street right-of-way.

Roxbury Crossing to Heath Street

Parcels 24 through 32a

Existing Land Use: These parcels are situated in an area which had predominantly manufacturing uses until the buildings were demolished for road construction. To the east, on much higher land than the Corridor, is the residential neighborhood of Highland Park (Fort Hill). To the west of the existing railroad embankment is a manufacturing strip along Terrace Street, above which is situated the residential neighborhood of Parker Hill.

Existing Zoning: M-2, some H-1 (vacant land).

Topography: The Corridor lies in a valley between Fort Hill and Parker Hill. The difference in grade from Corridor level to the crown of both hills is approximately 130 feet. The change in grade on the west (or Parker Hill) side is abrupt. A 60-foot rise occurs in between Terrace Street and Parker Street; however, this change occurs outside the Corridor. The change in grade on the east (or Fort Hill) side is more gradual than on the west side. A 60-foot rise occurs between Columbus Avenue and Centre Street, with much of the change occurring within the Corridor width.

Proposed Uses:

East Side: Parcels 24, 26, 28, 30 and 32:
Institutional use - the Roxbury Community College is presently undergoing site planning; regional trail and bikeway.

West Site: Parcels 27 and 29:
open space
Parcels 27a and 27b:
Adjacent to existing manufacturing
Parcels 25 and 31:
Expansion of existing manufacturing use or housing in the event that manufacturing does not continue to be a viable use in this area.

Impacts of Transportation Alternatives
Parcels 24 through 32

The effect of constructing the embanked alternatives will be to consign the land to the west of the transit/rail alignment to remain deficient in several development aspects for the life of the project. The parcels between the tracks and Terrace Street are very narrow (as average depth of approximately 75 feet); and contain old buildings which are presently used for light manufacturing and private housing. The steep cliff between Parker Street and Terrace Street forms a barrier to enlargement of land area to the west. The vacancy rate in these structures has increased over the years and there is a question of the viability of manufacturing as a use in this area. Efforts are being made to encourage manufacturing firms to locate in these structures. However, even if manufacturing continues to be viable in this location, the existing buildings have a life which is substantially less than that of the proposed transportation facility. When this area is ready for redevelopment at some future time, the development potential of these parcels will remain diminished due to the deficiencies present today: parcels have insufficient depth and usable area, and are blocked visually and physically by the presence of the embankment.

The depressed alternatives will allow future air-rights construction to improve the buildability of this land and will allow creation of dimensionally sufficient development parcels which would be impossible given the embanked alternatives. The fully depressed and Post-Hearing alternatives would allow simple air-rights structures at grade; the modified depressed alternatives allow an approximately at grade condition between Tremont Street and Cedar Street extension (parcel 27a); however, south of Cedar Street any air-rights structure would be one story above grade on the west (parcels 27b and 31). On the east it would be at grade. This would be reached through new development at grade adjacent to the air-rights portion.

Site planning for the Roxbury Community College contemplates using air-rights over the depressed transit/rail for future expansion. This future development could be accessible by means of pedestrian connections over Columbus Avenue.

The "no-build street" alternatives would decrease the land available on the east side for the proposed Roxbury Community College by one-half acre. Additionally, the parcels between the transit/rail alignment and existing Columbus Avenue are seen as being marginally developable due to their depth and the fact of being sandwiched between Columbus Avenue and the track alignment.

Jackson Square

Parcels 33 through 35

Existing Land Use: These parcels are situated in a former manufacturing area. To the west is the Bromley-Heath Housing. To the east are some existing manufacturing uses, the Boston Public Works Department Roxbury Yard, and Connolly Playground which serves the adjacent residential area.

Existing Zoning: M-1 and B-1

Topography: The Corridor land remains lower than adjacent land; however, the difference in grades is much less than in the previous section. Maximum change in grade is approximately 20 feet in 800 feet. The grade change on the east is gradual; the change on the west is abrupt in the vicinity of Lamartine Street where approximately one-half of the rise occurs.

Proposed Uses:

Parcel 33: Extension of the Bromley-Heath Playground combined with the proposed open space deck covering the rail depression; regional trail and bikeway.

Parcel 35: Additional open space, bikeway, and/or a community facility, and retail.

Parcel 34: And related land is proposed for a major residential/retail development. The excellent accessibility of Jackson Square by transit and automobile, combined with the surrounding residential area, should make this a prime site.

Impacts of Transportation Alternatives on Parcels

The embanked alternatives at Jackson Square will not permit an open space deck to be constructed over the transit/rail to provide additional open space for this dense project and the existing housing will be subject to increased noise and the adverse visual impact of the embankment. The existing housing would not meet current noise guidelines for federally assisted housing. All depressed alternatives allow the construction of an open space deck in similar configurations and elevations.

The "no-build street" alternative in both street segments 2 and 3, and the "no-build street" alternative for segment 3 which aligns "build" segment 2 into existing Columbus Avenue, both diminish the land area available for parcel 34 which is proposed as a prime site for retail and/or housing uses. The above alternatives also separate the land in parcel 35 which is presently the island in the middle of a rotary street system from the land available in parcel 34 and the underutilized land abutting parcel 34.

The "build street" segment 3 alternatives which meets Centre Street at a right angle provide the most buildable area for parcel 34.

7.4.3.3 Development Parcels - South End

Land development in the South End considers land in the Corridor from the South Cove tunnel portal near Arlington Street to Carter Playground near Northampton Street. No land is cleared at present for the transportation improvements, and one of the two Alternatives (SC-1) proposes clearance of parcels in seven locations, none of which contains a significantly large land area. This analysis will discuss development opportunities at Massachusetts Avenue Station, and at Back Bay Station as well as at the seven locations where takings occur under Alternative SC-1. The remainder of the Corridor lying within the South End will not be further discussed herein, for the following reasons: a) the MBTA or the MDPW do not own any land near the right-of-way which is proposed for non-transportation redevelopment, and b) any vacant land or vacant building adjacent to the right-of-way are subject to disposition by the Boston Redevelopment Authority under its Urban Renewal Plans.

Massachusetts Avenue Station

Existing Land Use: Residential, predominantly in four-story row-houses; ground floor commercial on Massachusetts Avenue; the Boston Arena and Northeastern University one block to the west; Symphony Hall and Horticultural Hall two blocks to the north. The block northwest of the station entrance is cleared vacant land.

Parcels 1 and 2: Residential (vacant).

Existing Zoning: B-2 (Massachusetts Avenue), H-1 (to the east), M-1 (to the west around Carter Playground) and H-3 Northeastern.

Topography: Flat, filled land, tracks in cut, Massachusetts Avenue grades up to bridge over tracks.

Proposed Uses: Minor retail space within Station; air-rights over tracks on one or both sides of Massachusetts Avenue combined with new development on adjacent vacant parcels. Retail, office, and residential.

Parcels 1 and 2: Retail, office, residential, open space.

Back Bay Station

Existing Land Use: Adjacent to Hancock Garage (2,000 cars), 4 story garage, and 8 story office building to the south. The Massachusetts Turnpike interchange is to the west across Dartmouth Street. Nearby uses are major office buildings to the north, such as John Hancock and Prudential, and residential structures of a smaller scale in the South End to the south.

Existing Zoning: B-8 and B-10, H-2

Topography: Flat filled land, tracks in cut, Dartmouth and Clarendon Streets grade up to bridge over tracks.

Proposed Uses: Retail space within station, office space in air-rights structure above station.

Impacts of Transportation Alternatives

Alternatives SC-1 and SC-2 are similar in their effects on development at Back Bay Station; however, the Tunnel Alternative (SC-2) to accommodate MBTA tracks would require different footing locations and design of supports for air-rights structures than the alternative having no tunnel (SC-1).

Clarendon Street to Berkeley Street

Parcels 3 through 7

Existing Land Use:
Parcel 3: Residential/Ground Floor Commercial
Parcels 4 and 5: Residential
Parcels 6 and 7: Commercial

Existing Zoning: B-4

Topography: Flat filled land, tracks and Massachusetts Turnpike in cut.

Proposed Uses:
Parcel 3: Residential retail, and/or open space.
Parcels 4 and 5: Open space and/or use by abuttors.
Parcel 6: Residential commercial, and/or open space
Parcel 7: Use by abuttor.

Impacts of Transportation Alternatives on Parcels 1 to 7

Alternative SC-1: Parcels 1 and 7 are created by demolition of existing structures.

Alternative SC-2: Parcels 1 through 2 are created by demolition of existing structures.

7.4.4 Parcel Descriptions

Figures VII-2 through VII-20 contain tabulations of areas and land uses for the development parcels indicated in the accompanying maps.

The areas are approximate and were measured from the maps; and therefore do not have surveyor's accuracy. The acreages shown for the parcels correspond to land that is inside the Corridor. Areas shown for "expansion" or "related parcel" (indicated by a suffixed "x") are for land that is outside the Corridor and, unless so specified, are privately owned (this land is shown within dotted lines on the maps).

The total area for development parcels consisting of land within the Corridor is approximately 85 acres. About 55 acres outside the Corridor are being considered for development, together with about 4.5 acres of proposed deck over the Orange Line and railroad right-of-way in the depressed alternatives.

7.4.5 Development Potential

Section 7.4.3 describes physical characteristics of the Corridor development parcels including existing land use, existing zoning, and topography, and then describes the uses which are being proposed for the parcels, under the various alternatives. Other physical properties such as accessibility to vehicles and pedestrians, and size and shape of the parcel were also considered in the determination of land uses. These land uses were determined not only from consideration of the physical characteristics outlined above, but, in addition, compatibility of the uses with adjacent neighborhoods was confirmed through public review.

Section 7.4.4 then lists each parcel and its proposed land use as well as miscellaneous comments.

Section 7.4.5 quantifies the development potential of the uses assigned to parcels in the Corridor. Uses are described in terms of areas of manufacturing space and ground floor retail space, dwelling units, or acres of open space, etc. Parking has been considered, based on the requirements of the zoning code of the City of Boston.

The figures develped in this section are a first cut at quantifying development in the Corridor on a parcel-by-parcel basis. The figures are based on estimates of the market viability of each use and, as such, are clearly subject to more detailed analysis.

Additional reports in the Corridor can utilize the land use information established in Section 7.4 and then further analyze each parcel for development potential in the context of marketability and financial feasibility. Such analysis would consider market information, land price and other cost data, and financing analysis to establish feasibility of the parcels for various development programs.

7.4.5.1 Development Potential - Jamaica Plain

A summary of development potential for Jamaica Plain is shown in Fig. VII-21. Parcel by parcel details are tabulated in Appendix L.

Housing development potential is similar for all alternatives. The major variable is the change in environmental quality caused by the choice of transit and street alternatives. This will directly affect the likelihood, pace and quality of residential construction.

Hotel/motel, office, manufacturing, and institutional uses are not directly affected by the choice of alternatives.

Retail and service retail uses are similar for the Depressed and Modified Depressed alternatives with the arterial street reducing retail physical potential at Jackson Square by about 10,000 square feet. The Embanked alternatives reduce retail potential by about 40,000 square feet, principally through reductions within the Forest Hills station complex.

Auto-oriented commercial is something of a catchall category encompassing a wide variety of small enterprises which require vehicular access and visibility. It does not depend on walk-in and local neighborhood patronage as does the retail category, and it is not characterized by intensive fabrication and assembly processes as is the manufacturing category. Representative auto-oriented commercial uses might be: Drive-in bank branch, dry cleaner, lumberyard, auto parts store, restaurant, new car dealership, appliance repair shop, diner, green house and garden supply center, etc. In many cases, certain uses are not environmentally or visually compatible with the surroundings; however, this is best judged on a case-by-case basis, and can be controlled by proper restrictions of sale of open land.

In analyzing much of the land in Jamaica Plain, it becomes apparent that the most reasonable new development would be as some form of auto-oriented commercial. A more precise identification of future use must await later stages of the project.

The arterial alternatives show about a 25% reduction in the amount of land available for auto-oriented commercial development, but an increase in auto exposure creating a higher market. If each establishment needs about 20,000 square feet, this represents about 23 establishments under arterial alternatives compared with 30 establishments under alternatives with no arterial.

The open space category shows a fairly uniform total area for all alternatives. A major greenbelt is included in all alternatives. For the arterial alternatives a portion of the greenbelt is a strip running between the curb and an arbitrary line a minimum of some fifteen feet from the curb. In certain zones where there is a nearby boundary or barrier, additional land is included as greenbelt since the land involved is not worth discussing as a separate parcel. "Greenbelt" land would accommodate sidewalks, bikepaths, a regional trail, grass, plantings, occasional benches add street furniture, etc. It is not intended for open space activities such as playgrounds, picnic areas, etc. because of its narrow dimension and proximity to street traffic though it serves to connect such activities in a continuous network. Alternative 2 has 32.8% of its open space in the greenbelt category and Depressed and Modified Depressed with Arterial have about 33% of their open space in the greenbelt category, while Embanked with Arterial has about 41% of its open space in the greenbelt system, since the embankment eliminates other uses. The No Arterial alternatives also have some small greenbelt areas; however, these would have to be augmented by portions of their active open spaces to accommodate the bikepaths, sidewalks, trails, etc. otherwise accommodated within the greenbelt.

The embanked alternatives FH-3 and FH-4, while showing comparable open space areas, will have significantly reduced utility of that open space because of the embankment slopes.

The Modified Depressed alternatives have very large stretches of auto-free pedestrian and bike way trails since these can pass under cross streets alongside the rail facility.

Community facilities have not been allocated separate land areas. It is assumed that they occur within designated open spaces or within structires built for other uses.

Land sold to abutters is generally narrow and/or inaccessible. The abutters are generally residential or industrial in nature. It is assumed that they will make use of the land; however, no significant new development is likely to result. There are no major differences between alternatives except to say that Depressed and Modified Depressed with Arterial takes a substantial portion of such land and uses it for the arterial street, avoiding reductions in other land categories.

Generally speaking, the major rail and street alternatives have some small impact on the total aggregate physical development potential in Jamaica Plain. Rail and street alternatives will have significant differences in the way they affect individual parcels and local neighborhood conditions. They will also have a major role in determining how rapidly development can be achieved and what quality of development can occur, particularly in proximity to the transportation facility. All Depressed alternatives will be conducive to earlier and higher quality development of all sorts. The Arterial Street alternatives FH-2 and FH-4 and PHP-2 will improve the market for retail and commercial uses as well as for initial sales and rentals of housing, but may have negative consequences for housing on a longer-term basis unless that housing is carefully sited and designed.

7.4.5.2 Development Potential - Roxbury

A summary of development potential for Roxbury is shown in Fig. VII-22. Parcel by parcel details are tabulated in Appendix L. The discussion of use quantities by Alternative in Section 7.4.5 shows very evident changes in land use in the Roxbury section when comparing the "build street" options (FH-2, FH-4, FH-5, FH-6, and PHP-1 & 2) to the "no-build street" in Roxbury options (FH-1 and FH-3).

a) When parcel 18 remains split by Columbus Avenue, assumptions have been made that the hotel remains adjacent to the transit/rail station and that retail is a stronger use than the office space on parcel 18b. For these reasons and the difficulty of sharing parking on a split site, the office space shown in the "build street" options is not shown in the "no build" street options.

b) Approximately 250,000 S.F. (5.75 acres) of institutional space is not readily available for use in the "no-build street" (FH-1 and FH-3), that is available in FH-2 and FH-4. Most of this land appears in the "build street" alternatives as expansion for the Campus High School complex (297,000 S.F.). In the no-build street alternatives only 70,000 S.F. of the above total is available; therefore, 227,000 S.F. (5.2 acres) is lost to Campus High School under the "no-build street" alternatives. Roxbury Community College has a land area of 452,000 S.F. in the Corridor under the "build street" alternatives (FH-2 and FH-4), and 432,000 under the "no-build street" alternatives. This is only a difference of 20,000 S.F. or approximately 1/2 acre; however, the parcel configuration in the "build street" situation is far more regular with all parcels having similar depths.

   In the Modifed and Post-Hearing Alternatives Campus High School has an expansion area of 267,000 S.F. which is 30,000 S.F. (0.7 acre) less than in the Fully Depressed alternatives. The Roxbury Community College has combined Corridor parcels totaling 383,500 S.F. as shown in the drawings of the Modified and Post-Hearing Alternatives as opposed to 452,000 in the Fully Depressed schemes; this is a difference of 68,500 S.F. or slightly over 1-1/2 acres. This difference is due to an improvement in railroad alignment rather than because of any change inherent in alternatives. It would occur if such an improvement were introduced in the Fully Depressed alternative, the reverse is also true.

c) The land area that has been lost to these institutional uses is mainly found in long narrow parcels (parcels 22 and 27) in the "no-build street" alternatives. These parcels have been designated for auto-oriented commercial uses (e.g., dry cleaner, auto parts store, fast food, green house and garden supply, drive-in bank, other drive-in uses, etc.). The lost land area in the Modified Depressed Alternatives is due to the straightening of the track alignment.

d) The parcel 18 area is most affected by the "no-build street" alternative: parcel 18 is split, allowing less flexibility for mixed development because the possibility of shared parking and direct access to the transit/rail station are eliminated. Parcel 16 is eliminated because Tremont Street remains. Parcel 16 is an open space buffer for the Whittier Street Housing and its size is approximately 30,000 S.F.

The differences in development potential between the depressed and the embanked transit/rail alternatives cannot be determined merely from the summary of area quantities by alternative in Section 7.4.5. Evaluation of individual parcels in each alternative must consider the various factors that affect marketability. Equally as critical are the adverse environmental and physical conditions associated with the embanked alternatives.

a) The hotel/motel, retail and office use categories are numerically constant with reference to depressed or embanked. The critical difference between these alternatives will be most pronounced in the marketability of the various sites. It is obvious that a hotel or office building will be far less marketable when erected adjacent to an elevated and noisier facility than when next to the same transportation elements when they are less obtrusive. These comments also apply to retail locations, although the impacts are not as severe as for office and hotel use. It must be noted that this problem still exists even with the addition of noise walls on the embankment, since decking and air-rights are virtually impossible in the embanked alternatives.

b) Housing is shown as an alternate use on parcels 18, 18b, 20, and 25. Housing <u>could not</u> be a use on parcels 18, 20, and 25 under the embanked alternatives, because of the presence of the elevated facility and its associated noise. The total assumed for the three parcels is 500 to 600 residential units.

c) Open space is shown as an adjunct to decks over the depressed transit/rail adjacent to the housing at Mission Hill and Bromley Heath. The open space on these decks <u>is not possible or available</u> under the embanked alternatives.

Manufacturing appears as a numerical constant in all alternatives (parcels 25 and 31). These parcels abut existing light manufacturing areas. The Terrace Street manufacturing strip (lying between parcels 25 and 31) is presently experiencing a rapid increase in vacancies and fire damage. The uses and future use of this area must be considered in all alternatives, although the land is outside any government ownership. Manufacturing is shown as an alternate use on parcel 27 in the "no-build street" alternatives.

d) Manufacturing and retail have slightly larger development potential in the Modified Depressed schemes than in other alternatives. This is mainly due to larger parcels to the west of the track alignment both because of the takings required at cross streets and the straightening of the track alignment. For these same reasons, somewhat less land is available on the east side of the alignment resulting in a small reduction of open space of approximately one acre.

e) The relatively small amounts of retail space that would be available in stations at Roxbury Crossing and Jackson Square has not been expressed in the tabulations. The large Joint Development possibility at Ruggles/Northeastern station appears in the tabulation for parcel 18.

7.4.5.3 Development Potential - South End

A summary of development potential for the South End is shown in Fig. VII-23. Parcel by parcel details are tabulated in Appendix L. Alternatives SC-1 and SC-2 each contain the largest parcel resulting from acquisition near Back Bay Station which is parcel 3. Parcel 3 has the possibility of being developed with the adjacent parking area, whereas parcels 4,5,6, and 7 (occurring in alternative SC-1) are small and suited to modest development that should be carefully coordinated and designed for compatibility with residences in the historic district.

Joint Development that could occur at Massachusetts Avenue Station and especially at Back Bay station has far more potential than the other relatively small parcels in the South End.

7.5 Flexibility for Future Transit Services

The extension of the relocated Orange Line to Forest Hills represents a step which permits many future alternatives for transit service. Design of the facility in all alternatives would allow for the immediate extension of new service on the Needham Branch. An environmental Impact Analysis for that facility is underway to determine its mode - whether rapid transit or upgraded commuter rail. A further extension of rapid transit toward Canton is also possible with the designs under consideration. The Canton extension is much more tentative, however, and is therefore presently included in the Forest Hills-Downtown improvements as a commuter rail facility.

The removal of the Washington Street El is anticipated as part of this project. The decision for the long-range service in the alignment of the present elevated structure is intended to be the subject of far-reaching review by other studies. The alternatives being studied for that service would not include the Orange Line, and is directed toward either light rail service or bus replacement, incorporating transit lanes where possible.

The proposed circumferential transit service would cross the alignment of the relocated Orange Line at Ruggles Street. At the present time, the mode of service for the circumferential line is undetermined. If bus, it would serve the new Ruggles Street Station along with other surface bus lines or in an exclusive right-of-way tunnel. If a rail option is chosen, it is probable that the new line would be in a tunnel under the relocated Orange Line, with connections for patrons by stairs and escalators into the Ruggles Street Station. The station design at Ruggles Street allows for these options.

7.6 Regional Path and Open Space System

The Relocated Orange Line, along with joint land development, provides an opportunity for simultaneous development of transportation facilities and adjacent vacant lands to result in major long term benefits to the region.

There has been concern throughout this analysis for the preservation and enhancement of public open spaces and other natural and man made resources which would be affected by transportation improvements in the Southwest Corridor. The short term impacts on such resources (in terms of land takings and other direct impacts) and the means by which future transportation and land development in the Corridor can lead to an increase in the quality of the environment in each neighborhood are important aspects of this project.

A fundamental element in the Southwest Corridor transit/rail and street project is the creation of a linear park path and open space system. The configuration of such a "Green Belt" could provide access to many existing and proposed recreational facilities in the Boston Region, and would encourage pedestrian and bicycle travel throughout the Corridor and adjacent neighborhoods.

On land abutting the railroad and transit right-of-way, a linear park system, supplementing existing regional trails, could run from Forest Hills to the Back Bay Station and Copley Square. In the land to either side of the Corridor, carefully selected lateral connector paths could connect historic and cultural resources of existing neighborhoods as well as provide safe efficient access to transit stations, community facilities and neighborhood parks and playgrounds. (Fig. A-14).

By coordinating the design of a regional path network with the City of Boston, the Bureau of Environmental Management, and/or the Metropolitan District Commission, a major opportunity to articulate and reinforce the unique characteristics of the communities through which the Corridor passes is acheivable. The overall open space pattern could provide a variety of experiences, active and passive, to serve local neighborhoods and the City as a whole. The proposed linear park network could provide a neighborhood collector system to serve the transit stations, permit a convenient and pleasant trip to the transit station, and include sufficient bicycle storage facilities encouraging the use of a bike through a portion of the trip to the transit facility. A regional path could provide an alternative to the negative impacts of noise and air pollution that often accompany pedestrian traffic on ordinary streets. The opportunity for controlled and limited automobile interface would greatly increase pedestrian and bicycle safety.

The regional pedestrian path would extend as a continuous green belt from Forest Hills north to Ruggles Street and Carter Playground varying in width to a minimum of 30 feet. The path will be suitably landscaped and paved to permit bicycle and pedestrian travel and to accommodate a variety of recreational pursuits from cross country skiing to community gardening. (Fig. A-16).

At Forest Hills the transit options significantly improve the visual and physical connectivity between the Arnold Arboretum and Franklin Park. This improved linkage can be substantially reinforced and articulated via an intensely landscaped pedestrian and bicycle path designed as part of a comprehensive path and open space system throughout the Corridor. (Fig. A-15).

Between Jackson Square and Ruggles Street in the Roxbury segment of the Corridor the opportunity exists to expand open space and recreation facilities in coordination with the path system through the use of decking and existing cleared land. A lateral pedestrian connector utilizing cleared land holdings could connect the regional path at Ruggles Street to the Fenway at the Museum of Fine Arts and provide safe and efficient pedestrian and bicycle access to Wentworth Institute, Northeastern University and other Fenway institutions.

The Carter Playground area is to be developed in coordination with the New Carter School. Necessary pedestrian bridges, paths, and easements could be acquired to permit safe and efficient passage to the Arena and the proposed Massachusetts Avenue transit station as well as all paths leading to and from the Playground. Direct access from the Massachusetts Avenue station to the Arena is being examined. At Massachusetts Avenue, there exists the potential for a lateral pedestrian connector to the Christian Science Center and in the opposite direction the growing City Hospital Complex. Intensive urban design and pedestrian amenities coordinated with the City of Boston would provide an attractive means to link these facilities of regional importance with the Corridor Path network.

In the South End a landscaped network of pedestrian oriented walkways, pocket parks and bridges utilizing Claremont and Carelton Streets which abut the Corridor, could provide access by means of the proposed Darmouth Street Mall to Copley Square, Commonwealth Avenue, the Explanade and the Commons. This network would be closely coordinated with ongoing plans for the reconstruction of Columbus Avenue and the Downtown bikeways and Freedom Trails system.

Critical to the development of a regional path and open space Green Belt system with a long term positive impact for the City and the Region, is a coordinated planning effort at every funding and operating agency level; Federal, State and Local. Careful design considerations for existing and proposed open space and community facility development as an element in the Southwest Corridor transportation planning will insure the project's contribution to the environmental quality of the region.

During the Public Hearing there was substantial support for the proposed Greenbelt which would parallel the proposed railroad and transit facilities. This would be carefully landscaped to include bikeways, screen planting, a "regional trail" and careful fencing of the rail right-of-way. The Metropolitan District Commission, the City of Boston, and other members of the Southwest Working Committee have been meeting as a "Task Force on Open Space" in order to plan for the facility. Their suggestions include the recommendation that the MBTA utilize landscape architecture disciplines on the design consultant team and that the care of maintenance of the greenbelt be by the Commonwealth through an appropriate park agency. The likely agent for such maintenance is the Metropolitan District Commission or the State Department of Environmental Management.

FIG. VII-1

SHORT TERM ECONOMIC IMPACTS DUE TO CONSTRUCTION

PROJECT ALTERNATIVE	Construction Cost ($ mill.)	CONSTRUCTION JOBS		CONSTRUCTION IMPACT	
		Man Years	Aver. Annual Man Years	Aver. Annual Payroll ($ mill.)	Mult. Effect on Economy ($ mill.)
• DEPRESSED RAIL/TRANSIT, NO ARTERIAL STREET					
- with minimum grade adjustments, all tracks	361.7	13,000	3,470	43.4	60.8
- with Orange Line in tunnel to Dartmouth Street	384.3	13,800	3,680	46.0	64.4
• DEPRESSED RAIL/TRANSIT, ARTERIAL STREET EAST					
- with minimum grade adjustments, all tracks	371.2	13,400	3,570	44.6	62.4
- with Orange Line in tunnel to Dartmouth Street	393.8	14,200	3,790	47.4	66.4
• RAIL/TRANSIT ON MODIFIED EMBANKMENT, NO ARTERIAL					
- with minimum grade adjustments for all tracks	164.4	5,900	2,360	29.5	41.3
- with Orange Line in tunnel to Dartmouth Street	188.3	6,800	2,470	30.9	43.3
• RAIL/TRANSIT ON MODIFIED EMBANKMENT, ARTERIAL CROSSING EAST TO WEST					
- with minimum grade adjustments, all tracks	177.8	6,400	2,560	32.0	44.8
- with Orange Line in tunnel to Dartmouth Street	201.8	7,300	2,650	33.1	46.3
• MODIFIED DEPRESSED RAIL/TRANSIT, NO ARTERIAL STREET SOUTH OF JACKSON SQUARE					
- with minimum grade adjustments, all tracks	242,3	8,700	2,180	27.2	38.1
- with Orange Line in tunnel to Dartmouth Street	266.2	9,600	2,400	30.0	42.0
• MODIFIED DEPRESSED RAIL/TRANSIT, ARTERIAL STREET EAST					
- with minimum grade adjustments, all tracks	249.2	9,000	2,250	28.1	39.3
- with Orange Line in tunnel to Dartmouth Street	273.3	9,800	2,450	30.6	42.8
• POST-HEARING PROFILE, NO ARTERIAL STREET TO JACKSON SQUARE	305.3	11,000	2,750	34.4	48.1
• POST-HEARING PROFILE, ARTERIAL STREET EAST	308.8	11,000	2,780	34.7	48.6

DRAWING REFERENCES IN THE FOLLOWING FIGURES:

For the sake of brevity in this Environmental Impact Statement certain drawings which appeared in the Environmental Impact Analysis have been removed. The plan information (alignment and Parcel numbers) is similar to the drawings PHP-1 and 2, although not identical. Profile information for all alternatives has been consolidated on the PHP-1 and 2 drawings. Representation sections of several alternatives have been included in this statement. Because the scale of the sections makes minor differences in elevation indistinguishable, the Post-Hearing Profile is not illustrated by separate section drawings but falls in between those of the Full and Modified Depression. Plans and Sections are found in the first section of Volume II of II. A correlation of the Plan sheets listed is as follows:

ORIGINAL DRAWING NUMBERS								NEW DRAWING NUMBERS	
SC-1	SC-2	FH-1	FH-2	FH-3	FH-4	FH-5	FH-6	PHP-1	PHP-2
IV-63	IV-66	--	--	--	--	--	--	IV-63	IV-63
IV-64	IV-67	--	--	--	--	--	--	IV-64	IV-64
IV-65	IV-68	--	--	--	--	--	--	IV-65	IV-65
--	--	IV-20	IV-27	IV-34	IV-41	IV-49	IV-56	IV-56	IV-49
--	--	IV-21	IV-28	IV-35	IV-42	IV-50	IV-57	IV-57	IV-50
--	--	IV-22	IV-29	IV-36	IV-43	IV-51	IV-58	IV-58	IV-51
--	--	IV-23	IV-30	IV-37	IV-44	IV-52	IV-59	IV-59	IV-52
--	--	IV-24	IV-31 &31A	IV-38	IV-45 &45A	IV-53	IV-60	IV-60	IV-53
--	--	IV-25	IV-32	IV-39	IV-46	IV-54	--	IV-54	IV-54
--	--	IV-26	IV-33	IV-40	IV-47	IV-55	--	IV-55	IV-55

PARCEL DESCRIPTIONS
JAMAICA PLAIN
FIGURE VII-2 TO VII-7

Fig. VII-2 Parcel Descriptions-Jamaica Plain FH-1

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
1	IV-20	97500	2.24	Auto-oriented commercial	Orange line yards to be closed. Orange Line shop could be re-used
2	IV-20	51415	1.18	Commercial and Housing	Continuation of present uses; return to private ownership.
3 & 4	IV-20	24889	.57	Housing and open space	Parcel 3 DPW owned, parcel 4 is not. Houses could be lifted to new street grade and fill added to site. Triangular end of parcel 4 should be left as open space. Vacant lots in parcel 3 should be filled to street grade and sold to abutters.
5	IV-20	54726	1.25	Commercial or manufacturing	About 15,000 sq. feet of Stony Brook right of way adjacent along rear of lot could be used for non-structural purposes.
6,7 & 8	IV-20	38025	.87	Commercial or manufacturing	About 23,000 sq. feet of Stony Brook right of way adjacent along rear of lots could be used for non-structural purposes. Land will have to be filled to new street grade.
9	IV-20	99,000	2.27	Green line yards and sale to residential abutters	A strip of land behind houses on Asticou Road should be filled to stop erosion. Land not needed for transit yards could be sold to abutters to expand their house lots.
10	IV-20	2780	.06	Housing	8 Asticou Road-- a 2 family house -- to be sold for rehabilitation and occupancy after street construction.
11	IV-20	25700	.59	Mixed retail, housing and professional offices	Parcel makes transition between residential and station areas.
12	IV-20	40500	.93	Open space	Gateway to Arboretum.
13	IV-95	FOREST HILLS STATION LOWER LEVEL			Approximately 50,000 square feet of retail catering to station users, local residents, and passing auto traffic. Some short term parking provided (see architectural drawings).
14	IV-95	FOREST HILLS STATION UPPER LEVEL			Approximately 18,000 square feet of retail facing pedestrian path between bus and rail terminals, short term parking at kiss and ride zone.
15	IV-20	60,000	1.38	Open space and plaza	Could be used for temporary outdoor shows, exhibitions, markets, etc.

Fig. VII-2 Parcel Descriptions-Jamaica Plain FH-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
16X	IV-20	111,900	2.57	Retail, office, motel, housing or parking garage. Could be a mixed use complex.	Privately owned. Developer might purchase additional properties on Hyde Park Avenue to expand area and gain frontage. Connection to station via pedestrian bridge is possible.
17	IV-20	20,000	.46	Open space	Relocate commercial parking to station deck. Landscaping should be low to maintain sight lines for traffic.
18	IV-20	40,000	.92	Open space or institutional	Relocate commerical parking to station deck. Reserve site for future municipal uses.
19X	IV-21	740,000	16.99	MBTA garage and commercial	Some land (up to 20,000 feet) at southwest corner could be developed for commercial use. Green space strip should be reserved from Washington to Franklin Park along Morton Street.
20X & 21X	IV-21	43700	1.00	Commercial	Land is presently vacant. Jenney Oil (the present owner) could develop this for more tank facilities or for commercial uses.
22	IV-21	25600	.59	Commercial	This parcel could be sold to Jenney Oil for more tank facilities or it could be combined with 20X and 21X to make a development parcel with an area of 69,300 feet.
23	IV-21	111,000	2.55	Industrial	Very poor access means only possible disposition is sale to abutters (mainly industrial)
24	IV-21	12,600	.29	Institutional	Possible site for relocation of American Legion Hall.
25	IV-21	18624	.43	Housing	Southern portion to be used for parking, nothern portion could be a house lot for a one or two family dwelling.
26	IV-21	155,000	3.56	Housing and/or open space	Housing development could place clusters of units at ends of dead end streets with passages through to open space. Open space could be landscaped to give each street its own distinctive area. Parking should be provided at each cul de sac. Nearest the rail right of way is the beginning of the linear open space linkage (See Sheet A-14 Chapter 7) which contains pedestrian walk and bikeway. A distinct landscape feature could define the boundary between this public open space and the street-related semi-public open spaces.
27X	IV-21	29415	.68	Housing	Could be assembled with parcels 29 and 30 to create a development area of 68,287 feet.
29	IV-21	23051	.53	Housing	Could be grouped with parcels 27X and 30

Fig. VII-2 Parcel Descriptions-Jamaica Plain FH-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
30	IV-21	15821	.36	Housing	Could be grouped with parcels 27X and 29. Standing houses to be rehabilitated or demolished.
31	IV-21	3387	.08	Housing	Too small to develop, sell to an abutter. Could be joined with a privately owned vacant lot to the south to create a house lot for a one to three family house.
32	IV-21	8386	.19	Housing	Could be developed with a one to three family house.
33	IV-21	4098	.09	Housing	Vacant lot between 32 and 33 could be purchased to expand house lot.
34	IV-21	19760	.45	Housing related	Parcel is shallow making development difficult. Sell to abutters on Newbern Street to expand yards.
35	IV-21	48500	1.11	Open space and/or institutional	After allowing for walk and bikeway, useable width is about seventy feet. Possible location for community facility.
36	IV-21	49,000	1.12	Open space and/or institutional	Useable width is about sixty feet. Possible location for community facility.
37	IV-21	41500	.95	Open space or housing	Deck over tracks is not to be built at this time. Combination of parcels 35, 37 and 38 gives an area of about 140,000 feet
38	IV-21	50,000	1.15	Open space	Transfer to High School use. Useable width is about 85 feet.
39a & 39b	IV-21	74,000	1.70	Open space	Transfer to High School use. Useable width about 85 feet. Probably will provide the major pedestrian route between High School and Green Street station.
40X	IV-21	216700	4.97	Institutional	Site of new Southwest II district High School.
41X	IV-21	247400	5.68	Institutional	Athletic fields for High School.
42	IV-22				Unsuitable for rehabilitation, transfer land parcel to 36 or 43X.
43X	IV-22	3300	.08	Housing	Part of back yards and one garage structure will be taken for transit purposes. If possible, some adjacent land should be made available to offset the reduction. Parts of parcels 42 and 44 could be transferred.

Fig. VII-2 Parcel Descriptions-Jamaica Plain FH-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
44	IV-22			Housing	Area included in parcel 45. Structure to be sold for residential rehabilitation. Bishop Street can be closed and some of the land used to enlarge the rear and side yards.
45	IV-22	44,000	1.01	Housing or open space	Large frame dwelling to be sold off separately with about 10,000 feet of land. Parcel was apparently quarried or excavated at one time, then filled. Subsoil conditions may prevent development except as open space
46	IV-22	6000	.14	Retail or housing	Close to Green Street Station. Could combine retail with housing above.
48T	IV-22	GREEN STREET STATION			Approximately 2400 square feet of small scale convenience retail incorporated in station design.
49X	IV-22	27,800	.64	Retail or commercial	Building at south end of site could remain.
52	IV-22	97,000	2.23	Open space	Connects Johnson Playground to open space network
53	IV-22	110,000	2.53	Open space or manufacturing	Ninety foot width could accommodate some active open space uses. Noise environment limits development opportunities to manufacturing.
54	IV-22	83,000	1.91	Open space or manufacturing	100 foot width could accommodate some active open space uses. Noise environment limits development opportunities to manufacturing.
55	IV-22			Open space	Merges into parcel 52
56	IV-23	151,000	3.47	Open space	130 foot width compares with about 175 width at present. Suitable for medium scale playfields.
57	IV-23	51,000	1.17	Open space or retail	If parcel 54 is open space, then parcel 57 should also be open space with a walkway from the vicinity of the Neighborhood House to Boylston Street Station. Alternative development is retail near station.
58X	IV-23	12430	.29	Open space or housing - related	Could be incorporated in open space system or could be sold to abutters to expand yards.
59	IV-23	BOYLSTON STREET STATION			Approximately 2,400 sq. feet of small scale convenience retail incorporated in station design.
60X	IV-23	21697	.50	Retail or housing	Could combine retail and housing
61X	IV-23	4550	.10	Retail	Small size limits development to single story retail. Eventually this entire block might be assembled for a more coordinated mixed-use development.

Fig. VII-2 Parcel Descriptions-Jamaica Plain FH-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
62X	IV-23	30879	.71	Housing, institutional or commercial	Suitable for apartment,, elderly housing, nursing home or commercial.
63	IV-23	54600	1.25	Open space	Ninety foot width permits small to medium scale active open space uses.
64	IV-23	55000	1.26	Open space	Maintain as open space. Stony Brook conduit prohibits construction.
65	IV-23	14202	.33	Housing or commercial	Should have same treatment as parcel 66. Potential early development site.
66	IV-23	48117	1.10	Housing or commercial	Parking could occur on parcel 67 to permit better quality development here. Potential early development site.
67	IV-23	92600	2.13	Housing or commercial	Without decking over tracks the noise environment and shallowness of the site limit development to very minor commercial (auto parts & repairs, small warehouses and distributors, etc.) Housing could not occur until decking over tracks is feasible.
68	IV-23	60,500	1.39	Open space or housing	Open space linkage moves entirely to East side of tracks here to take advantage of open space around 125 Amory elderly housing. When decking over tracks is feasible, parcels 65 through 74X plus the deck area could be combined to make a mixed use development parcel of approximately 13.8 acres.
69	IV-23	55500	1.27	Open space, commercial, or manufacturing	Poor vehicular access discourages development. Combine with parcels 70X and 71.
70X	IV-24	38130	.88	Commercial or manufacturing	Could be developed for a higher grade of commercial use or could be combined with parcel 71 for a mixed use development.
71	IV-24	100,500	2.31	Mixed retail and commercial	Development must allow for pedestrian walk and bikeway to connect from parcel 68 past parcel 69 and through to an appropriate point on Centre Street.
72	IV-24	30931	.71	Same as parcel 71	Should be developed in conjunction with parcel 71.
73X	IV-24	11867	.27	Housing or commercial	Should follow development pattern set by parcels 65, 66 and 67.
74X	IV-24	14177	.33	Retail and housing	Close to Jackson Square Station. Good location for convenience retail.
75X	IV-24	249562	5.73	Mixed uses: manufacturing, public facilities, open space	Site of Plant Shoe Factory which burned February 1, 1976
Total		4,072,369	92.57		
Total in Corr.		2,268,812	51.17		
Total Adjacent		1,803,557	41,40		

Fig. VII-3 Parcel Descriptions-Jamaica Plain FH-2

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
1	IV-27	97,500	2.24	Auto-oriented commercial	Orange Line yards to be closed. Orange Line shop could be re-used.
2	IV-27	51,415	1.18	Commercial and housing	Continuation of present uses; return to private ownership.
3 & 4	IV-27	24,889	.57	Housing and open space	Parcel 3 is DPW owned, parcel 4 is not. Houses could be lifted to new street grade and fill added to site. Triangular end of parcel 4 should be left as open space. Vacant lots in parcel 3 should be filled to street grade and sold to abutters.
5	IV-27	54,726	1.25	Commercial or manufacturing	About 15,000 square feet of Stony Brook right of way adjacent along rear of lot could be used for non-structural purposes.
6,7 & 8	IV-27	38,025	.87	Commercial or manufacturing	About 23,000 square feet of Stony Brook right of way adjacent along rear of lots could be used for non structural purposes. Land will have to be filled to new street grade.
9	IV-27	99,000	2.27	Green Line yards and sale to housing abutters.	A strip of land behind houses on Asticou Road should be filled to stop erosion. Land not needed for transit yards could be sold to abutters to expand their house lots.
10	IV-27	2780	.06	Housing	8 Asticou Road - a 2 family house - to be sold for rehabilitation and occupancy after street construction.
11	IV-27	25,700	.59	Mixed retail, housing and professional offices	Parcel makes transition between residential and station areas.
12	IV-27	40,500	.93	Open space	Gateway to Arboretum.
13	IV-95	FOREST HILLS STATION LOWER LEVEL			Approximately 50,000 square feet of retail catering to station users, local residents and passing auto traffic, Some short term parking provided (see architectural drawings).
14	IV-95	FOREST HILLS STATION UPPER LEVEL			Approximately 18,000 square feet of retail facing pedestrian path between bus and rail terminals, short term parking at kiss and ride zone.
15	IV-27	60,000	1.38	Open space and plaza	Could be used for temporary outdoor shows, exhibitions, markets, etc.
16X	IV-27	111,900	2.57	Retail, office, motel, housing, or parking garage, could be mixed use complex	Privately owned. Developer might purchase additional properties on Hyde Park Avenue to expand area and gain frontage. Connection to station via pedestrian bridge is possible.

Fig. VII-3 Parcel Descriptions-Jamaica Plain FH-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
17	IV-27	20,000	.46	Open space	Relocate commercial parking to station deck. Landscaping should be low to maintain sight lines for traffic.
18	IV-27			Open space or institutional	Relocate commerical parking to station deck. Reserve site for future municipal uses.
19X	IV-28	740,000	16.99	MBTA garage and commercial	Some land (up to 20,000 feet) at southwest corner could be added to parcel 20 to enlarge development parcel.
20	IV-28	20,400	.47	Commercial	Corner has good visibility and large traffic volumes. Parcel area could increase to about 40,000 feet with addition from 19X.
21X	IV-28	8500	.28	Commercial	Land is presently vacant. Jenney Oil (the present owner) could develop this for more tank facilities or for commercial use.
22	IV-28	13,200	.30	Commercial	Same advantages as parcel 20. Suitable for small commercial activity not needing large amounts of parking.
24	IV-28	12,600	.29	Institutional	Possible site for relocation of American Legion Hall.
25	IV-28	18,624	.43	Housing	Southern portion to be used for parking, northern portion could be a house lot for a one or two family dwelling.
26	IV-28	155,000	3.56	Housing and/or open space	Housing development could place clusters of units at ends of dead end streets with passages through to open space. Open space could be landscaped to give each street its own distinctive area. Parking should be provided at each cul de sac. Nearest the rail right of way is the beginning of the linear open space linkage (see Sheet A-14 Chapter 7) which contains pedestrian walk and bikeway. A distinct landscape feature could define the boundary between this public open space and the street-related semi-public open spaces.
27X	IV-28	29,415	.68	Housing	Could be assembled with parcels 29 and 30 to create a development area of 68,287 feet.
29	IV-28	23,051	.53	Housing	Could be grouped with parcels 27X and 30.
30	IV-28	15,821	.36	Housing	Could be grouped with parcels 27X and 29. Standing houses to be rehabilitated or demolished.
31	IV-28	3387	.08	Housing	Too small to develop, sell to an abutter. Could be joined with a privately owned vacant lot to the south to create a house lot for a one to three family house.

Fig. VII-3 Parcel Descriptions-Jamaica Plain FH-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
32	IV-28	8386	.19	Housing	Could be developed with a one to three family house.
33	IV-28	4098	.09	Housing	Vacant lot between 32 and 33 could be purchased to expand house lot.
34	IV-28	19,760	.45	Housing related	Parcel is shallow making development difficult. Sell to abutters on Newbern Street to expand yards.
35	IV-28	48,500	1.11	Open space and/or institutional	After allowing for walk and bikeway, useable width is about seventy feet. Possible location for community facility.
36	IV-28	35,500	.81	Open space and/or institutional	Useable width is about sixty feet. Possible location for community facility.
37	IV-28	41,500	.95	Open space or housing	Deck over tracks is not to be built at this time. Combination of parcels 35, 37 and greenbelt on west side of arterial gives an area of about 98,000 feet.
38	IV-28	8000	.18	Open space	Strip between arterial and High School. Combined with the greenbelt strip along the Arterial this makes a parcel with an area of 16,000 feet and a width of about thirty feet from building to curb line.
39	IV-28	11,000	.25	Open space	Combined with the greenbelt strip along the Arterial this makes a parcel of 32,000 feet area and about 25 feet average width.
40X	IV-28	216,700	4.97	Institutional	Site of new Southwest II district high school.
41X	IV-28	247,400	5.68	Institutional	Athletic fields for High School.
42	IV-29			Open space	Included in parcel 36.
43X	IV-29	3300	.08	Housing	Part of back yards will be taken for transit purposes. If possible, some adjacent land should be made available to offset the reduction. Parts of parcels 42 and 44 could be transferred.
44	IV-29			Housing	Included in parcel 45 Structure to be sold for residential rehabilitation. Bishop Street can be closed and some of the land used to enlarge the rear and yard.
45	IV-29	44,000	1.01	Housing or open space	Large frame dwelling to be sold off separately with about 10,000 feet of land. Parcel was apparently quarried or excavated at one time, then filled. Subsoil conditions may prevent development except as open space.
46	IV-29	6000	.14	Retail or housing	Close to Green Street Station. Possibly could combine retail with housing above.
48T	IV-29	GREEN	STREET	STATION	Approximately 2400 square feet of small scale convenience retail incorporated in station design.

Fig. VII-3 Parcel Descriptions-Jamaica Plain FH-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
49X	IV-29	27,800	.64	Retail or commercial	Arterial Street improves retail potential of this corner. Building at south end of site could remain.
50	IV-29	3541	.08	Manufacturing	Transfer to AAA salvage (adjacent to the South).
51	IV-29	1000	.02	Greenbelt	Keep as open space or sell to abutter.
52	IV-29	102,000	2.34	Open space	Connects Johnson Playground to open space network.
53	IV-29	29,000	.67	Open space	Mostly too narrow for use other than greenbelt. Wider area at Green Street could have a small, landscaped sitting area. Curb of Amory to curb of Arterial runs from thirty to forty feet.
54	IV-29	23,800	.55	Open space	Curb of Amory to curb of Arterial runs from forty feet to about sixty feet. Area in front of Neighborhood House should get special design to make it useable and safe.
55	IV-29	8400	.19	Housing	Lot for a one to three family house.
56	IV-30	153,000	3.51	Open space	130 foot width compares with about 175 foot width at present. Suitable for medium scale playfields.
57	IV-30	6100	.14	Open space	Becomes part of Greenbelt.
58X	IV-30	12,480	.29	Open space or housing	Could be incorporated in open space system or could be sold to abutters to expand yards.
59	IV-30	B O Y L S T	O N S T	R E E T S T A T I O N	Approximtely 2400 square feet of small scale convenience retail incorporated in station design.
60X	IV-30	21,697	.50	Retail or housing related	Could combine retail and housing
61X	IV-30	4550	.10	Retail	Small size limits development to single story retail. Eventually this entire block might be assembled for a more coordinated mixed-use development.
62X	IV-30	30,879	.71	Housing or institutional	Closure of Lamartine Street means development must front on Danforth. Suitable for apartments, elderly housing or nursing home.
63	IV-30	64,100	1.47	Open space and housing or institutional	Parcel incorporates land recovered from Lamartine Street right of way. Utility easements will have to be maintained. Open space linkage should be provided for, however, balance of site could be developed in conjunction with parcel 62X.

Fig. VII-3 Parcel Descriptions-Jamaica Plain FH-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
64	IV-30	12,500	.29	Greenbelt	Not wide enough for active use. Merge into greenbelt system.
65	IV-30	14,202	.33	Housing or commercial	Should have same treatment as parcel 66. Potential early development site.
66	IV-30	48,117	1.10	Housing or commercial	Parking could occur on parcel 67 to permit better quality development here. Potential early development site.
67	IV-30	92,600	2.13	Housing or commercial	Without decking over tracks the noise environment and shallowness of the site limits development to very minor commercial (auto parts and repairs, small warehouses and distributors, etc.). Housing could not occur until decking over tracks is feasible.
68	IV-30	---	--	Greenbelt	Open space linkage moves entirely to East side of tracks here to take advantage of open space around 125 Amory elderly housing. When decking over tracks is feasible, parcels 65 through 74X plus the deck area could be combined to make two related mixed use development parcels of approximately 11 acres total area.
69	IV-30	15,800	.36	Open space, commercial or manufacturing	Poor vehicular access discourages development. Combine with parcel 71.
71	IV-31	79,000	1.81	Mixed retail and commercial	Development must allow for pedestrian walk and bikeway to connect from parcel 69 through to an appropriate point on Centre Street.
73X	IV-31	11,867	.27	Housing or commercial	Should follow development pattern set by parcels 65, 66 and 67.
74X	IV-31	14,177	.33	Retail and housing	Close to Jackson Square Station. Good location for convenience retail.
75X	IV-31	249,562	5.73	Mixed uses: manufacturing, public facilities, open space	Site of Plant Shoe Factory which burned February 1, 1976.
Total		3,426,749	78.44		
Total in Corr.		1,696,522	38.72		
Total Adjacent		1,730,227	39.72		

Fig. VII-4 Parcel Descriptions-Jamaica Plain FH-3

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
1	IV-34	115,000	2.64	Auto-oriented commercial	Orange Line yards to be closed. Orange Line shop could be re-used.
2	IV-34	51,415	1.18	Commercial and housing	Continuation of present uses; return to private ownership.
3	IV-34	10,189	.23	Housing	Continuation of present uses; return to private ownership.
4	IV-34	36,000	.83	Open space	Vacant land (formerly Gemini Motors) should be landscaped. Embankment slope prevents active usage.
5	IV-34	54,726	1.25	Commercial or manufacturing	About 15,000 feet of Stony Brook right of way adjacent along rear of lot could be used for non-structural purposes.
6	IV-34	6273	.14	Retail or commercial	Could be sold to abutters or redeveloped. About 1500 feet of Stony Brook right of way adjacent along rear of lot could be used for non-structural purposes.
8	IV-34	7600	.17	Commercial or open space	About 15,000 feet of Stony Brook right of way adjacent along rear of lot could be used for non-structural purposes making a lot area of 22,600 feet.
9	IV-34	99,000	2.27	Green Line yards and sale to residential abutters.	A strip of land behind houses on Asticou Road should be filled to stop erosion. Land not needed for transit yards could be sold to abutters to expand their house lots.
10	IV-34	2780	.06	Housing	8 Asticou Road - a 2 family house - to be sold for rehabilitation and occupancy after street construction.
11	IV-34	25,700	.59	Mixed retail, housing and professional offices	Parcel makes transition between residential and station areas.
12	IV-34	40,500	.93	Open spaces	Gateway to Arboretum
13	IV-93	FOREST HILLS STATION LOWER LEVEL			Does not exist in this alternative.
14	IV-93	FOREST HILLS STATION UPPER LEVEL			Approximately 10,000 square feet of retail faces pedestrian path between bus and rail terminals, short term parking at kiss and ride zone.
15	IV-34	60,000	1.38	Open space and retail	Part of area under tracks could be enclosed to create a retail area of about 15,000 feet.

Fig. VII-4 Parcel Descriptions-Jamaica Plain FH-3 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
16X	IV-34	111,900	2.57	Retail, office, motel, housing or parking garage. Could be a mixed use complex	Privately owned. Developer might purchase additional properties on Hyde Park Avenue to expand area and gain frontage. Connection to station via pedestrian bridge is possible.
17	IV-34	20,000	.46	Open space	Relocate commercial parking to station deck or to parcel 16X commercial parking garage. Landscaping should be low to maintain sight lines for traffic.
18	IV-34	40,000	.92	Open space or institutional	Relocate commercial parking to station deck or to parcel 16X commercial parking garage. Reserve site for future municipal uses.
19X	IV-35	740,000	16.99	MBTA garage and retail	Some land (up to 20,000 feet) at southwest corner could be developed for commercial use. Green space strip should be reserved from Washington to Franklin Park along Morton Street.
20X & 21X	IV-35	43,700	1.00	Commercial	Land is presently vacant. Jenney Oil (the present owner) could develop this for more tank facilities or for commercial use.
22	IV-35	25,600	.59	Commercial	This parcel could be sold to Jenney Oil for more tank facilities or it could be combined with 20X and 21X to make a development parcel with an area of 69,300 feet.
23	IV-35	99,000	2.27	Industrial	Very poor access - only possible disposition is sale to abutters (mainly industrial). Embankment slope limits usefulness.
24	IV-35	12,600	.29	Institutional	Possible site for relocation of American Legion Hall.
25	IV-35	18,624	.43	Housing	Southern portion to be used for parking, northern portion could be a house lot for a one or two family dwelling.
26	IV-35	182,800	4.20	Housing and/or open space	Housing development could place clusters of units at ends of dead end streets with passages through to open space. Open space could be landscaped to give each street its own distinctive area. Parking should be provided at each cul de sac. Nearest the rail right of way is the beginning of the linear open space linkage (See Sheet A-14 in Chapter 7) which contains pedestrian walk and bikeway. A distinct landscape feature could define the boundary between this public open space and the neighborhood-related semi-public open spaces.
27X	IV-35	29,415	.68	Housing	Could be assembled with parcels 29 and 30 to create a development area of 68,287 feet.
28	IV-35	33,500	.77	Open space/slope	Embankment slope suitable for landscape but not for active use. Walk and bikeway at foot of slope near Call Street.

Fig. VII-4 Parcel Descriptions-Jamaica Plain FH-3 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
29	IV-35	23,051	.53	Housing	Could be grouped with parcels 27X and 30.
30	IV-35	15,821	.36	Housing	Could be grouped with parcels 27X and 29. Standing houses to be rehabilitated or demolished.
31	IV-35	3387	.08	Housing	Too small to develop, sell to an abutter. Could be joined with a privately owned vacant lot to the south to create a house lot for a one to three family house.
32	IV-35	8386	.19	Housing	Could be developed with a one to three family house.
33	IV-35	4098	.09	Housing	Vacant lot between 32 and 33 could be purchased to expand house lot.
34	IV-35	19,760	.45	Housing	Parcel is shallow making development difficult. Sell to abutters on Newbern Street to expand yards.
35	IV-35	83,200	1.91	Open space or housing	After allowing for walk and bikeway, useable width is about 150 feet. Embankment slope is about forty feet wide reducing the flat area to about 100 feet of useable width. Development should be coordinated with parcel 26 to insure that a children's playground is available at at least one location.
36	IV-35	70,500	1.62	Open space or housing	Embankment encroaches same as parcel 35. Useable width is about 100 feet.
38	IV-35	20,300	.47	Open space	Mostly at level of old embankment about 15 feet above McBride and Williams.
39	IV-35	22,500	.52	Open space /slope	Mostly embankment side with sharp slope.
40X	IV-35	216,700	4.97	Institutional	Site of new Southwest II district high school.
41X	IV-35	247,400	5.68	Institutional	Athletic fields for high school.
42	IV-36	5735	.13	Housing	Unsuitable for rehabilitation. Make available to city for improvement of Everett/Call Street intersection. Sell remaining land to abutter.
43X	IV-36	4793	.11	Housing	Probably will not be affected under this option. Continue in present use.
44	IV-36	3060	.07	Housing	Brick townhouse suitable for rehabilitation.
45	IV-36	51,767	1.19	Housing or open space	Includes a large frame dwelling which may be sold off separately. Parcel was apparently quarried or excavated at one time, then filled. Subsoil conditions may prevent development except as open space.
46	IV-36	8563	.20	Retail or housing	Close to Green Street Station. Could combine retail with housing above.
47	IV-36	3000	.07	Open space or parking	Too shallow for development.

Fig. VII-4 Parcel Descriptions-Jamaica Plain FH-3 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
48	IV-36	GREEN STREET STATION			Approximately 2400 square feet of small scale convenience retail incorporated in station design.
49X	IV-36	24,000	.55	Retail or commercial	Fronts on Station loop street. Building at south end of site could remain.
52	IV-36	175,500	4.03	Open space	120 foot width could accommodate some active open space uses. Undulating topography links to Johnson Playground.
53	IV-36	52,500	1.21	Open space/slope	Mostly embankment slope, too steep and narrow for active use.
54	IV-36	49,500	1.14	Open space/slope	Mostly embankment slope, too steep and narrow for active use.
56	IV-37	220,000	5.05	Open space	Maintains present 175 foot width. Suitable for large scale playfields.
57	IV-37	8200	.19	Open space/slope	Mostly embankment slope, too steep and narrow for active use.
58X	IV-37	12,480	.29	Open space or housing related	Could be incorporated in open space system or could be sold to abutters to expand yards.
59	IV-37	BOYLSTON STREET STATION			Approximately 2400 square feet of small scale convenience retail incorporated in station design.
60X	IV-37	21,697	.50	Retail or housing	Could combine retail and housing
61X	IV-37	4550	.10	Retail	Small size limits development to single story retail. Eventually this entire block might be assembled for a more coordinated mixed use development.
62X	IV-37	30,879	.71	Housing, institutional or commercial.	Suitable for apartments, elderly housing, nursing home or commercial.
63	IV-37	65,500	1.50	Open space	Ninety to 110 foot width permits small to medium scale active open space uses. Embankment reduces usability.
64	IV-37	39,500	.91	Commercial	Stony Brook conduit prohibits construction. Embankment reduces usability. Sell to abutters for minor expansion or parking.
65	IV-37	14,202	.33	Commercial	Should have same treatment as parcel 66.
66	IV-37	48,117	1.10	Commercial	Parking could occur on parcel 67 to allow denser development here.

Fig. VII-4 Parcel Descriptions-Jamaica Plain FH-3 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
67	IV-37	92,600	2.13	Commercial	Shallowness of site and grade changes limit development to very minor commercial (auto parts and repairs, small warehouses and distributors, etc.)
68	IV-37	52,000	1.19	Open space/slope	Mostly embankment slope, too steep and narrow for active use, pedestrian walk and bike path at foot of embankment with connections to 125 Amory elderly housing complex.
69	IV-37	55,500	1.27	Open space, commercial or manufacturing	Poor vehicular access discourages development. Develop in conjunction with parcels 70X and 71 or leave as open space.
70X	IV-38	38,130	.88	Commercial or manufacturing	Could be developed for a higher grade of commercial use or could be combined with parcel 71 for a mixed use development.
71	IV-38	100,500	2.31	Mixed retail and commercial	Development must allow for pedestrian walk and bikeway to connect from parcel 68 past parcel 69 and through to an appropriate point on Centre Street.
72	IV-38	30,931	.71	Mixed retail and commercial	Should be developed in conjunction with parcel 71.
73X	IV-38	11,867	.27	Commercial or manufacturing	Should follow development pattern set by parcels 65, 66 and 67.
74X	IV-38	14,177	.33	Retail and housing	Close to Jackson Square Station. Good location for convenience retail.
75X	IV-38	249,562	5.73	Mixed uses: manufacturing, public facilities, open space	Site of Plant Shoe Factory which burned February 1, 1976
Total		4,090,235	93.90		
Total in Corr.		2,288,985	52.55		
Total Adjacent		1,801,250	41.35		

Fig. VII-5 Parcel Description-Jamaica Plain FH-4

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
1	IV-41	115,000	2.64	Auto-oriented commercial	Orange Line yards to be closed. Orange Line shop could be re-used.
2	IV-41	51,415	1.18	Commercial and housing	Continuation of present uses return to private ownership.
3	IV-41	10,189	.23	Housing	Continuation of present uses; return to private ownership.
4X	IV-41			Housing and open space	Existing house will remain as is. Vacant land (formerly Gemini Motors) should be landscaped.
5	IV-41	54,726	1.25	Commercial or manufacturing	About 15,000 feet of Stony Brook right of way adjacent along rear of lot could be used for non-structural purposes.
6	IV-41	6273	.14	Retail or commercial	Could be sold to abutters or redeveloped. About 1500 feet of Stony Brook right of way adjacent along rear of lot could be used for non-structural purposes.
8	IV-41	7600	.17	Commercial or open space	About 15,000 feet of Stony Brook right of way adjacent along rear of lot could be used for non-structural purposes making a lot area of 22600 feet.
9	IV-41	99,000	2.27	Green Line yards and sale to residential abutters	A strip of land behind houses on Asticou Road should be filled to stop erosion. Land not needed for transit yards could be sold to abutters to expand their house lots.
10	IV-41	2780	.06	Housing	8 Asticou Road - a 2 family house - to be sold for rehabilitation and occupancy after street construction.
11	IV-41	25,700	.59	Mixed retail, housing and professional offices	Parcel makes transition between residential and station areas.
12	IV-41	40,500	.93	Open space	Gateway to Arboretum
13	IV-93	FOREST HILLS STATION LOWER LEVEL			Does not exist in this alternative.
14	IV-93	FOREST HILLS STATION UPPER LEVEL			Approximately 10,000 square feet of retail faces pedestrian path between bus and rail terminals, short term parking at kiss and ride zone.
15	IV-41	60,000	1.38	Open space and retail	Part of area under tracks could be enclosed to create a retail area of about 15,000 feet.

Fig. VII-5 Parcel Description-Jamaica Plain FH-4 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
16X	IV-41	111,900	2.57	Retail, office, motel, housing or parking garage. Could be a mixed use complex.	Privately owned. Developer might purchase additional properties on Hyde Park Avenue to expand area and gain frontage. Connection to station via pedestrian bridge is possible.
17	IV-41	20,000	.46	Open space	Relocate commercial parking to station deck or to parcel 16X commercial parking garages. Landscaping should be low to maintain sight lines for traffic
18	IV-41	40,000	.92	Open space or institutional	Relocate commercial parking to station deck or to parcel 16X commercial parking garage. Reserve site for future municipal uses.
19X	IV-42	740,000	16.99	MBTA garage and commercial	Some land (up to 20,000 feet) at southwest corner could be added to parcel 20 to enlarge development parcel. Green space strip should be reserved from Washington to Franklin Park along Morton Street.
20	IV-42	20,400	.47	Commercial	Corner has good visibility and large traffic volumes. Parcel area could increase to about 40,000 feet with addition from 19X.
21X	IV-42	8500	.28	Commercial	Land is presently vacant. Jenney Oil (the present owner) could develop this for more tank facilities or for commercial use.
22	IV-42	13,200	.30	Commercial	Same advantages as parcel 20. Suitable for small retail activity not needing large amounts of parking.
23	IV-42	92,000	2.11	Industrial	Very poor access, only possible disposition is sale to abutters (mainly industrial). Embankment slope limits usefulness.
24	IV-42	12,600	.29	Institutional	Possible site for relocation of American Legion Hall.
25	IV.42	18,624	.43	Housing	Southern portion to be used for parking, northern portion could be a house lot for a one or two family dwelling.
26	IV.42	144,500	3.32	Housing and/or open space	Housing development could place clusters of units at ends of dead end streets with passages through to open space. Parking should be provided at each cul de sac. Land rises to the East, then drops down to the arterial street. A major north-south pedestrian walk and bikeway parallels the arterial.
27X	IV.42	27,300	.63	Housing	Could be assembled with parcels 29 and 30 to create a development area of 66,700 feet.
29	IV.42	25,700	.59	Housing	Could be grouped with parcels 27X and 30.
30	IV.42	13,700	.31	Housing	Could be grouped with parcels 27X and 29. Standing houses to be rehabilitated or demolished.

Fig. VII-5 Parcel Description-Jamaica Plain FH-4 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
31	IV-42	3387	.08	Housing related	Too small to develop, sell to an abutter. Could be joined with a privately owned vacant lot to the south to create a house lot for a one to three family house.
32	IV-42	8386	.19	Housing	Could be developed with a one to three family house.
33	IV-42	4098	.09	Housing	Vacant lot between 32 and 33 could be purchased to expand house lot.
34	IV-42	19,760	.45	Housing related	Parcel is shallow making development difficult. Sell to abutters on Newbern Street to expand yard.
35	IV-42	33,500	.77	Open space	Useable width is about fifty feet.
36	IV-42	20,500	.47	Open space	Useable width is about 45 feet. Incorporates parcel 42.
38	IV-42	20,300	.47	Open space	Mostly at level of old embankment about 15 feet above McBride and Williams.
39	IV-42	22,500	.52	Open space/slope	Mostly embankment side with sharp slope.
40X	IV-42	216,700	4.97	Institutional	Site of new Southwest II district high school.
41X	IV-42	247,400	5.68	Institutional	Athletic fields for High School.
43X	IV-43	---		Housing or open space	Part of parcel 45.
44	IV-43	---		Housing or open space	Part of parcel 45.
45	IV-43	38,200	.88	Housing or open space	Incorporates parcels 43 and 44. Includes a large frame dwelling which may be sold off separately. Parcel was apparently quarried or excavated at one time, then filled. Subsoil conditions may prevent development except as open space.
46	IV-43	5500	.13	Retail or housing	Close to Green Street Station and visible from Arterial. Could combine retail with housing above.
47	IV-43	12,500	.29	Retail, housing or commercial	Close to Green Street Station and fronting on Arterial. Could combine retail with housing above.
48	IV-43	G R E E N	S T R E E	T S T A T I O N	Approximately 2400 square feet of small scale convenience retail incorporated in station design.
49X	IV-43	27,800	.64	Retail or commercial	Fronts on Station loop street. Building at south end of site could remain.

Fig. VII-5 Parcel Description-Jamaica Plain FH-4 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
52	IV-43	57,500	1.32	Open space/slope	Narrow and steeply sloped. Only useable as greenbelt.
53	IV-43	51,000	1.17	Open space/slope	Mostly embankment slope. Too steep and narrow for active use.
54	IV-43	58,500	1.34	Open space/slope	Mostly embankment slope. Too steep and narrow for active use.
55	IV-43	7000	.16	Housing	Lot for a one or two family house.
56	IV-44	68,400	1.57	Open space	Eightly foot width limits active use to small scale play areas. Present width in this area is about 175 feet.
57	IV-44	8200	.19	Open space/slope	Mostly embankment slope. Too steep and narrow for active use.
58X	IV-44	12,480	.29	Open space or housing	Could be incorporated in open space system or could be sold to abutters to expand yards.
59	IV-44	BOYLSTON STREET STATION			Approximately 2400 square feet of small scale convenience retail incorporated in station design.
60X	IV-44	21,697	.50	Retail or housing	Could combine retail and housing
61X	IV-44	4550	.10	Retail	Small size limits development to single story retail. Eventually this entire block might be assembled for a more coordinated mixed use development.
62X	IV-44	30,879	.71	Housing, insitutional or commercial	Closure of Lamartine Street means development must front on Danforth. Suitable for apartments, elderly housing, nursing home or commercial. Latter use would require additional curb cut on arterial.
63	IV-44	83,000	1.91	Housing, institutional or commercial plus open space	Could be partially developed in conjunction with parcel 62X. Open space linkage should be accommodated parallel to arterial. Commercial use would require additional curb cut on arterial.
64	IV-44	28,200	.65	Commercial	Sell to abutters for minor expansion or parking.
65	IV-44	14,202	.33	Commercial	Should have same treatment as parcel 66. Potential early development site.
66	IV-44	48,117	1.10	Commercial	Parking could occur on parcel 67 to allow denser development here. Potential early development site.
67	IV-44	92,600	2.13	Commercial	Shallowness of site and grade changes limit development to very minor commercial (auto parts and repairs, small warehouses and distributors, etc.)
69	IV-44	15,800	.36	Open space, commercial or manufacturing	Poor vehicular access discourages development. Combine with parcel 71.

Fig. VII-5 Parcel Description-Jamaica Plain FH-4 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
	IV-45	79,000	1.81	Mixed retail and commercial	Development must allow for pedestrian walk and bikeway to connect from parcel 69 through to an appropriate point on Centre Street.
73X	IV-45	11,867	.27	Commercial	Should follow development pattern set by parcels 65, 66 and 67.
74X	IV-45	14,177	.33	Retail and housing	Close to Jackson Square Station. Good location for convenience retail.
75X	IV-45	249,562	5.73	Mixed uses: manufacturing, public facilities,open space	Site of Plant Shoe Factory which burned February 1, 1976.
Total		3,398,869	78.03		
Total in Corr.		1,785,957	41.00		
Total Adjacent		1,612,912	37.03		

Fig. VII-6 Parcel Descriptions-Jamaica Plain FH-5 and PHP-2

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
1	IV-49	97,500	2,24	Auto-oriented commercial	Orange Line yards to be closed, Orange Line shop could be re-used.
2	IV-49	51,415	1.18	Commercial and housing	Continuation of present uses: return to private ownership.
3 & 4	IV-49	24,889	.57	Housing and open space	Parcel 3 is DPW owned, parcel 4 is not. Houses could be lifted to new street grade and fill added to site. Triangular end of parcel 4 should be left as open space. Vacant lots in parcel 3 should be filled to street grade and sold to abutters.
5	IV-49	54,726	1.25	Commercial or manufacturing	About 15,000 square feet of Stony Brook right of way adjacent along rear of lot could be used for non-structural purposes.
7X	IV-49	24,152	.55	Housing	Parcel 6 and Stony Brook right of way used to construct alleyways for cars. Parcel 7X includes houses and one business which will not be taken but will have new access provisions from the raised street. The fruit and vegetable stand might be raised to street level if this is necessary for business purposes.
8	IV-49	8,501	.20	Commercial	Parcel 8 could be filled and returned to its present use, however, the duration of the construction period will be long enought that a permanent relocation is preferable for business continuity. Note that the two structures appear to be on railroad and MDC land. These will have to be removed. The resulting parcel 8 should be graded up to the raised Washington Street and down at the rear to the newly constructed alleway. This would permit a two story structure with access at both upper and lower levels. Note that this solution for parcels 6, 7 and 8 is interchangeable with the solution described for alternatives 1 and 2 The choice between solutions can be made at a later date after further engineering studies and consultation with the property owners involved.
9	IV-49	99,000	2.27	Green Line yards and sale to housing abutters	A strip of land behind houses on Asticou Road should be filled to stop erosion. Land not needed for Green Line yards could be sold to abutters to expand their house lots.
10	IV-49	2,780	.06	Housing	8 Asticou Road - a 2 family house - to be sold for rehabilitation and occupancy after street construction.
11	IV-49	25,700	.59	Mixed retail, Housing and professional offices	Parcel makes transition between residential and station areas.

Fig. VII-6 Parcel Descriptions-Jamaica Plain FH-5 and PHP-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
12	IV-49	40,500	.93	Open Space	Gateway to Arboretum.
13	IV-95	FOREST HILLS STATION LOWER LEVEL			Approximately 50,000 square feet of retail catering to station users, local residents and passing auto traffic. Some short term parking provided (see architectural drawings).
14	IV-95	FOREST HILLS STATION UPPER LEVEL			Approximately 18,000 square feet of retail facing pedestrian path between bus and rail terminals, short term parking at kiss and ride zone.
15	IV-49	60,000	1.38	Open Space and Plaza	Could be used for temporary outdoor shows, exhibitions, markets, etc.
16X	IV-49	111,900	2.57	Retail, office, motel, housing, or parking garage, could be mixed use complex	Privately owned. Developer might purchase additional properties on Hyde Park Avenue to expand area and gain frontage. Connection to station via pedestrian bridge is possible.
17	IV-49	20,000	.46	Open Space	Relocate commercial parking to station garage. Landscaping should be low to maintain sight lines for traffic.
18	IV-49	40,000	.92	Open space or institutional	Relocate commercial parking to station garage. Reserve site for future municipal uses.
19X	IV-50	730,000	16.76	MBTA garage and commercial	Some land (up to 20,000 feet) at southwest corner could be added to parcel 20 to enlarge development parcel.
20	IV-50	29,800	.68	Commercial	Corner has good visibility and large traffic volumes. Could combine with parcel 21X.
21X	IV-50	8,500	.28	Commercial	Land is presently vacant. Jenney Oil (the present owner) could develop this for more tank facilities or for commercial use. Could combine with parcels 20,
22	IV-50	25,000	.57	Commercial	Same advantages as parcel 20. Suitable for small commercial activity not needing large amounts of parking.
24	IV-50	11,600	.27	Institutional	Possible site for relocation of American Legion Hall.
25	IV-50	18,624	.43	Housing	Southern portion to be used for parking, northern portion could be a house lot for a one or two family dwelling.

Fig. VII-6 Parcel Descriptions-Jamaica Plain FH-5 and PHP-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
26	IV-50	155,000	3.56	Housing and/or open space	Housing development could place clusters of units at ends of dead end streets with passages through to open space. Open space could be landscaped to give each street its own distinctive area. Parking should be provided at each cul de sac. Nearest the rail right of way is the beginning of the linear open space linkage (see Figure A-15 in Section 7.6 and in appendix) which contains pedestrian walk and bikeway. A distinct landscape feature could define the boundary between this public open space and the street-related semi-public open spaces.
27X	IV-50	29,415	.68	Housing	Could be assembled with parcels 29 and 30 to create a development area of 91,629 feet. Land should be filled to new street level.
29	IV-50	30,814	.71	Housing	Could be grouped with parcels 27X and 30.
30	IV-50	31,400	.72	Housing	Could be grouped with parcels 27X and 29. Standing houses to be rehabilitated or demolished.
31	IV-50	3,387	.08	Housing	Two small to develop, sell to an abutter. Could be joined with a privately owned vacant lot to the south to create a house lot for a one to three family house, or could be added to parcel 30.
32	IV-50	8,386	.19	Housing	Could be developed with a one to three family house.
33	IV-50	4,098	.09	Housing	Vacant lot between 32 and 33 could be purchased to expand house lot. Combine with parcel 33a.
33a	IV-50	6,940	.16	Housing	New street grade requires that two houses be lifted and land filled and regraded.
34	IV-50	19,760	.45	Housing related	Parcel is shallow making development difficult. Sell to abutters on Newbern Street to expand yards.
34a	IV-50	3,337	.08	Housing	New street grade requires that two houses be lifted and land filled and regraded.
35	IV-50	32,000	.73	Open space and/or institutional	After allowing for walk and bikeway, useable width is about seventy feet. Possible location for community facility.

Fig. VII-6 Parcel Descriptions-Jamaica Plain FH-5 and PHP-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
36	IV-50	32,900	.75	Open space and/or institutional	Useable width is about sixty feet. Possible location for community facility. Includes parcel 42.
38	IV-50	8,000	.18	Open space/slope	Strip between arterial and High School. Combined with the greenbelt strip along the Arterial this makes a parcel with an area of 16,000 feet and a width of about thirty feet from building to curb line.
39	IV-50	11,000	.25	Open space/slope	Combined with the greenbelt strip along the Arterial this makes a parcel of 32,000 feet area and about 25 feet average width.
40X	IV-50	216,700	4.97	Institutional	Site of new Southwest II district high school.
41X	IV-50	247,400	5.68	Institutional	Athletic fields for High School.
42	IV-51			Open space	Included in parcel 36.
43X	IV-51	3,300	.08	Housing	Part of back yards will be taken for transit purposes. If possible, some adjacent land should be made available to offset the reduction. Parts of parcels 42 and 44 could be transferred.
44	IV-51			Housing	Included in parcel 45. Structure to be sold for residential rehabilitation. Bishop Street can be closed and some of the land used to enlarge the rear and yard.
45	IV-51	44,000	1.01	Housing or open space	Includes parcel 44. Large frame dwelling to be sold off separately with about 10,000 feet of land. Parcel was apparently quarried or excavated at one time, then filled. Subsoil conditions may prevent development except as open space.
46	IV-51	6,000	.14	Retail or housing	Close to Green Street Station. Possibly could combine retail with housing above.
48T	IV-51	G R E E	N S T R	E E T S T A T I O N	Approximately 2,400 square feet of small scale convenience retail incorporated in station design.
49X	IV-51	27,800	.64	Retail or commercial	Arterial Street improves retail potential of this corner. Building at south end of site could remain.
50	IV-51	18,700	.43	Retail or open space	Could be developed with - small retail structure with open space or could be left completely open.

Fig. VII-6 Parcel Descriptions-Jamaica Plain FH-5 and PHP-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
51	IV-51	6,100	.14	Greenbelt	Keep as open space or sell to abutter.
52	IV-51	102,000	2.34	Open space	Connects Johnson Playground to open space network.
53	IV-51	24,600	.56	Open space/slope	Mostly too narrow for use other than greenbelt. Wider area at Green Street could have a small, landscaped sitting area. Curb of Amory to curb of Arterial runs from thirty to forty feet.
54	IV-51	52,000	1.19	Open space/slope	Curb of Amory to curb of Arterial runs from forty feet to about sixty feet. Area in front of Neighborhood House should get special design to make it useable and safe.
55	IV-51	8,400	.19	Housing	Lot for a one to three family house.
56	IV-52	110,500	2.54	Open space	130 foot width compares with about 175 foot width at present. Suitable for medium scale playfields.
57	IV-52	17,000	.39	Open space or retail and housing	Could combine with parcel 57X. Makes transition between neighborhood and station area.
57X	IV-52	7,731	.18	Open space or retail and housing	Should be combined with parcel 57 if possible.
58	IV-52	12,480	.29	Open space or housing related	Could be incorporated in open space system or could be sold to abutters to expand yards.
59	IV-52	BOYLSTON STREET STATION			Approximately 2400 square feet of small scale convenience retail incorporated in station design.
60X	IV-52	21,697	.50	Retail or housing related	Could combine retail and housing. Should be filled to new street level.
61a	IV-52	4,550	.10	Retail	Small size limits development to single story retail. Eventually this entire block might be assembled for a more coordinated mixed-use development.
61b	IV-52	4,413	.10	Housing	Lamartine Street is raised substantially. Houses could be raised and land filled in. Alternate solution would move Lamartine Street closer to tracks with a slope down to the houses at their present level. Houses need not be permanently taken in either case.
62X	IV-52	30,879	.71	Housing or institutional	Closure of Lamartine Street means development must front on Danforth. Suitable for apartments, elderly housing or nursing home.

Fig. VII-6 Parcel Descriptions-Jamaica Plain FH-5 and PHP-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
63	IV-52	61,900	1.42	Open space and housing or institutional	Parcel incorporates land recovered from Lamartine Street right of way. Utility easements will have to be maintained. Open space linkage should be provided for, however, balance of site could be developed in conjunction with parcel 62X.
64	IV-52	15,800	.36	Greenbelt	Not wide enough for active use. Merge into greenbelt system.
64a	IV-52	7,450	.17	Open space	Fill to new street grade. Provides linkage between Church and Station area.
65	IV-52	14,202	.33	Housing or commercial	Should have same treatment as parcel 66. Potential early development site.
65a	IV-52	7,983	.18	Housing	Could be combined with parcel 65X after filling to new street level.
65X	IV-52	7,197	.17	Housing	Could be combined with parcel 65a.
66	IV-52	130,400	2.99	Housing or commercial	Includes parcel 67. Without decking over tracks the noise environment and shallowness of the site limits development to commercial. Housing could not occur until decking over tracks is feasible.
68	IV-52	---	--	Greenbelt	Open space linkage moves entirely to East side of tracks here to take advantage of open space around 125 Amory elderly housing. When decking over tracks is feasible, parcels 65 through 74X plus the deck area could be combined to make two related miexed use development parcels of approximately 11 acres total area.
69	IV-52	20,300	.47	Open space, commercial or manufacturing	Poor vehicular access discourages development. Combine with parcel 71.
71	IV-53	78,600	1.80	Mixed retail and commercial	Development must allow for pedestrian walk and bikeway to connect from parcel 69 through to an appropriate point on Centre Street.
73X	IV-53	11,867	.27	Housing or commercial	Should follow development pattern set by parcels 65,66 and 67.
74	IV-53	14,177	.33	Retail and housing	Close to Jackson Square Station. Good location for co-venience retail.
75X	IV-53	249,562	5.73	Mixed uses: manufacturing, public facilities, open space	Site of Plant Shoe Factory which burned February 1, 1976.

Fig. VII-6 Parcel Descriptions-Jamaica Plain FH-5 and PHP-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
Total		3,446,712	79.13		
Total in Corridor		1,718,612	39.45		
Total Adjacent		1,728,100	39.67		

Fig. VII-7 Parcel Descriptions-Jamaica Plain FH-6 and PHP-1

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
1	IV-56	97,500	2.24	Auto-oriented commercial	Orange line yards to be closed. Orange Line shop could be re-used.
2	IV-56	51,415	1.18	Commercial and Housing	Continuation of present uses: return to private ownership.
3 & 4	IV-56	24,889	.57	Housing and open space	Parcel 3 DPW owned, parcel 4 is not. Houses could be lifted to new street grade and fill added to site. Triangular end of parcel 4 should be left as open space. Vacant lots in parcel 3 should be filled to street grade and sold to abutters.
5	IV-56	54,726	1.25	Commercial or manufacturing	About 15,000 sq. feet of Stony Brook right of way adjacent along rear of lot could be used for non-structural purposes.
7X	IV-56	24,152	.55	Housing	Parcel 6 and Stony Brook right of way used to construct alleyway for cars. Parcel 7X includes houses and one business which will not be taken but will have new access provisions from the raised street. The fruit and vegetable stand might be raised to street level if this is necessary for business purposes.
8	IV-56	8,501	.20	Commercial	Parcel 8 could be filled and returned to its present use, however, the duration of the construction period will be long enought that a permanent relocation is preferable for business continuity. Note that the two structures appear to be on railroad and MDC land. These will have to be removed. The resulting parcel 8 should be graded upt to the raised Washington Street and down at the rear to the newly constructed alleyway. This would permit a two story structure with access at both upper and lower levels. Note that this solution for parcels 6, 7 & 8 is interchangeable with the solution described for alternatives 1 and 2. The choice between solutions can be made at a later date after further engineering studies and consultation with the property owners involved.
9	IV-56	99,000	2.27	Green Line yards and sale to residential abutters	A strip of land behind houses on Asticou Road should be filled to stop erosion. Land not needed for Green Line yards could be sold to abutters to expand their house lots.
10	IV-56	2,780	.06	Housing	8 Asticou Road-- a 2 family house -- to be sold for rehabilitation and occupancy after street construction.
11	IV-56	25,700	.59	Mixed retail, housing and professional offices	Parcel makes transition between residential and station areas.

Fig. VII-7 Parcel Descriptions-Jamaica Plain FH-6 and PHP-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
12	IV-56	40,500	.93	Open space	Gateway to Arboretum.
13	IV-95	FOREST HILLS STATION LOWER LEVEL			Approximately 50,000 square feet of retail catering to station users, local residents, and passing auto traffic. Some short term parking provided (see architectural drawings).
14	IV-95	FOREST HILLS STATION UPPER LEVEL			Approximately 18,000 square feet of retail facing pedestrian path between bus and rail terminals, short term parking at kiss and ride zone.
15	IV-56	60,000	1.38	Open space and plaza	Could be used for temporary outdoor shows, exhibitions, markets, etc.
16X	IV-56	111,900	2.57	Retail, office, motel, housing or parking garage. Could be a mixed use complex.	Privately owned. Developer might purchase additional properties on Hyde Park Avenue to expand area and gain frontage. Connection to station via pedestrian bridge is possible.
17	IV-56	20,000	.46	Open space	Relocate commercial parking to station garage. Landscaping should be low to maintain sight lines for traffic.
18	IV-56	40,000	.92	Open space or institutional	Relocate commercial parking to station garage. Reserve site for future municipal uses.
19X	IV-57	740,000	16.99	MBTA garage and commercial	Some land (up to 20,000 feet) at southwest corner could be developed for commercial use. Green space strip should be reserved from Washington to Franklin Park along Morton Street.
20X & 21S	IV-57	43,700	1.00	Commercial	Land is presently vacant. Jenney Oil (the present owner) could develop this for more tank facilities or for commercial uses. Land would have to be fill ed to raised street level.
22	IV-57	25,000	.57	Commercial	This parcel could be sold to Jenney Oil for more tank facilities or it could be combined with 20X and 21X to make a development parcel with an area of 68,700 feet.
23	IV-57	111,000	2.55	Industrial	Very poor access means only possible disposition is sale to abutters (mainly industrial).
24	IV-57	11,600	.27	Institutional	Possible site for relocation of American Legion Hall.

Fig. VII-7 Parcel Descriptions-Jamaica Plain FH-6 and PHP-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
25	IV-57	18,624	.43	Housing	Southern portion to be used for parking, northern portion could be a house lot for a one or two family dwelling.
26	IV-57	155,000	3.56	Housing and/or open space	Housing development could place clusters of units at ends of dead end streets with passages through to open space. Open space could be landscaped to give each street its own distinctive area. Parking should be provided at each cul de sac. Nearest the rail right of way is the beginning of the linear open space linkage (See figure A-15 in section 7.6 and in appendix which contains pedestrian walk and bikeway. A distinct landscape feature could define the boundary between this public open space and the street-related semi-public open spaces.
27X	IV-57	29,415	.68	Housing	Could be assembled with parcels 29 and 30 to create a development area of 68,287 feet. Land should be filled to new street level.
29	IV-57	30,814	.71	Housing	Could be grouped with parcels 27X and 30.
30	IV-57	15,821	.36	Housing	Could be grouped with parcels 27X and 29. Standing houses to be rehabilitated or demolished.
31	IV-57	3,387	.08	Housing	Too small to develop, sell to an abutter. Could be joined with a privately owned vacant lot to the south to create a house lot for a one to three family house.
32	IV-57	8,386	.19	Housing	Could be developed with a one to three family house.
33	IV-57	4,098	.09	Housing	Vacant lot between 32 and 33 could be purchased to expand house lot. Combine with parcel 33a.
33a	IV-57	6,940	.16	Housing	New street grade requires that two houses be lifted and land filled and regraded.
34	IV-57	19,760	.45	Housing related	Parcel is shallow making development difficult. Sell to abutters on Newbern Street to expand yards.
34a	IV-57	3,337	.08	Housing	New street grade requires that two houses be lifted and filled and regraded.

Fig. VII-7 Parcel Descriptions-Jamaica Plain FH-6 and PHP-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
35	IV-57	48,500	1.11	Open space and/or institutional	After allowing for walk and bikeway, useable width is about seventy feet. Possible location for community facility.
36	IV-57	49,000	1.12	Open space and/or institutional	Useable width is about sixty feet. Possible location for community facility.
38	IV-57	40,500	.93	Open space	Transfer to High School use.
39a & 39b	IV-57	64,900	1.49	Open space	Transfer to High School use. Probably will provide the major pedestrian route between High School and Green Street station.
40X	IV-57	216,700	4.97	Institutional	Site of new Southwest II district High School.
41X	IV-57	247,400	5.68	Institutional	Athletic fields for High School.
42	IV-58			Open Space	Included in parcel 36
43X	IV-58	3,300	.08	Housing	Part of back yards and one garage structure will be taken for transit purposes. If possible, some adjacent land should be made available to offset the reduction. Parts of parcels 42 and 44 could be transferred.
44	IV-58			Housing	Included in parcel 45. Structure to be sold for residential rehabilitation. Bishop Street can be closed and some of the land used to enlarge the rear and side yards.
45	IV-58	44,000	1.01	Housing or open space	Includes parcel 44. Large frame dwelling to be sold off separately with about 10,000 feet of land. Parcel was apparently quarried or excavated at one time, then filled. Subsoil conditions may prevent development except as open space.
46	IV-58	6,000	.14	Retail or housing	Close to Green Street Station. Could combine retail with housing above.
48T	IV-58	G R E E N	S T R E E	T S T A T I O N	Approximately 2,400 square feet of small scale convenience retail incorporated in station design.
48a	IV-58	5,400	.12	Open space	Deck over tracks links Johnson Playground and parcel 52 with parcel 53 on east side of tracks.
49X	IV-58	27,800	.64	Retail or commercial	Building at south end of site could remain.

Fig. VII-7 Parcel Descriptions-Jamaica Plain FH-6 and PHP-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
52	IV-58	97,000	2.23	Open space	Connects Johnson Playground to open network.
53	IV-58	74,100	1.70	Open space or manufacturing	Ninety foot width could accommodate some active open space uses. Noise environment limits development opportunities to manufacturing.
54	IV-58	146,900	3.37	Open space or manufacturing	100 foot width could accommodate some active open space uses. Noise environment limits development opportunities to manufacturing.
55	IV-58	8,400	.19	Housing	Lot for a one to three family house.
56	IV-59	91,500	2.10	Open space	Suitable for medium scale playfields.
56a	IV-59	14,600	.34	Open space	Parcel created by realignment of Lamartine Street.
57	IV-59	24,600	.56	Open space or retail and housing	Could combine with parcel 57X. An open space linkage should be maintained at the west side of the parcel along the tracks. Mixed retail and housing recommended.
57X	IV-59	7,731	,18	Open space or retail and housing	Should be combined with parcel 57 if possible.
58	IV-59	12,480	.29	Open space or housing - related	Could be incorporated in open space system or could be sold to abutters in expand yards.
59	IV-59	B O Y L S	T O N	S T R E E T S T A T I O N	Approximately 2,400 sq. feet of small scale convenience retail incorporated in station design.
60X	IV-59	21,697	.50	Retail or housing	Could combine retail and housing. Should be filled to new street level.
61a	IV-59	4,550	.10	Retail	Small size limits development to single story retail. Eventually this entire block might be assembled for a more coordinated mixed-use development.
61b	IV-59	4,413	.10	Housing	Lamartine Street is raised substantially. Houses could be raised and land filled in. Alternate solution would move Lamartine Street closer to tracks with a slope down to the houses at their present level.
62X	IV-59	30,879	.71	Housing, institutional or commercial	Suitable for apartment, elderly housing, nursing home or commercial.
63	IV-59	48,200	1.11	Open space	Ninety foot width permits small to medium scale active open space uses.

Fig. VII-7 Parcel Descriptions-Jamaica Plain FH-6 and PHP-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
64	IV-59	55,000	1.26	Open space	Maintain as open space. Stony Brook conduit prohibits construction.
64a	IV-59	7,450	.17	Open space	Fill to new street grade. Provides a linkage between church and station area.
65	IV-59	14,202	.33	Housing or commercial	Should have same treatment as parcel 66. Potential early development site.
65a	IV-59	7,983	.18	Housing	Could be combined with parcel 65X after filling to new street level.
65X	IV-59	7,197	.17	Housing	Could be combined with parcel 65a.
66	IV-59	48,117	1.10	Housing or commercial	Parking could occur on parcel 67 to permit better quality development here. Potential early development site.
67	IV-59	74,100	1.70	Open space or housing	Without decking over tracks the noise environment and shallowness of the site prohibit development. Housing could not occur until decking over tracks is feasible. Slope down to track level limits usefulness of open space except as visual amenity.
68	IV-59	52,800	1.21	Open space or housing	Open space linkage moves entirely to East side of tracks here to take advantage of open space around 125 Amory elderly housing. When decking over tracks is feasible, parcels 65 through 74X plus the deck area could be combined to make a mixed use development parcel of approximately 13.8 acres.
69	IV-59	58,800	1.27	Open space, commercial, or manufacturing	Poor vehicular access discourages development. Combine with parcels 70X and 71.
70X	IV-60	38,130	.88	Commercial or manufacturing	Could continue in present use as Cappy's Tow Lot. Could be developed for a higher grade of commercial use or could be combined with parcel 71 for a mixed use development.
71	IV-60	142,900	3.28	Mixed retail and commercial	Development must allow for pedestrian walk and bikeway to connect from parcel 68 past parcel 69 and through to an appropriate point on Centre Street.
73X	IV-60	11,867	.27	Housing or commercial	Should follow development pattern set by parcels 65,66 and 67.
74	IV-60	14,177	.33	Retail and housing	Close to Jackson Square Station. Good location for convenience retail.

Fig. VII-7 Parcel Descriptions-Jamaica Plain FH-6 and PHP-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
75X	IV-60	249,562	5.73	Mixed uses: manufacturing, public facilities, open space	Site of Plant Shoe Factory which burned February 1, 1976.
Total		4,010,780	92,07		
Total in Corridor		2,199,350	50.49		
Total Adjacent		1,811,430	41.58		

PARCEL DESCRIPTIONS
ROXBURY
FIGURE VII-8 TO VII-18

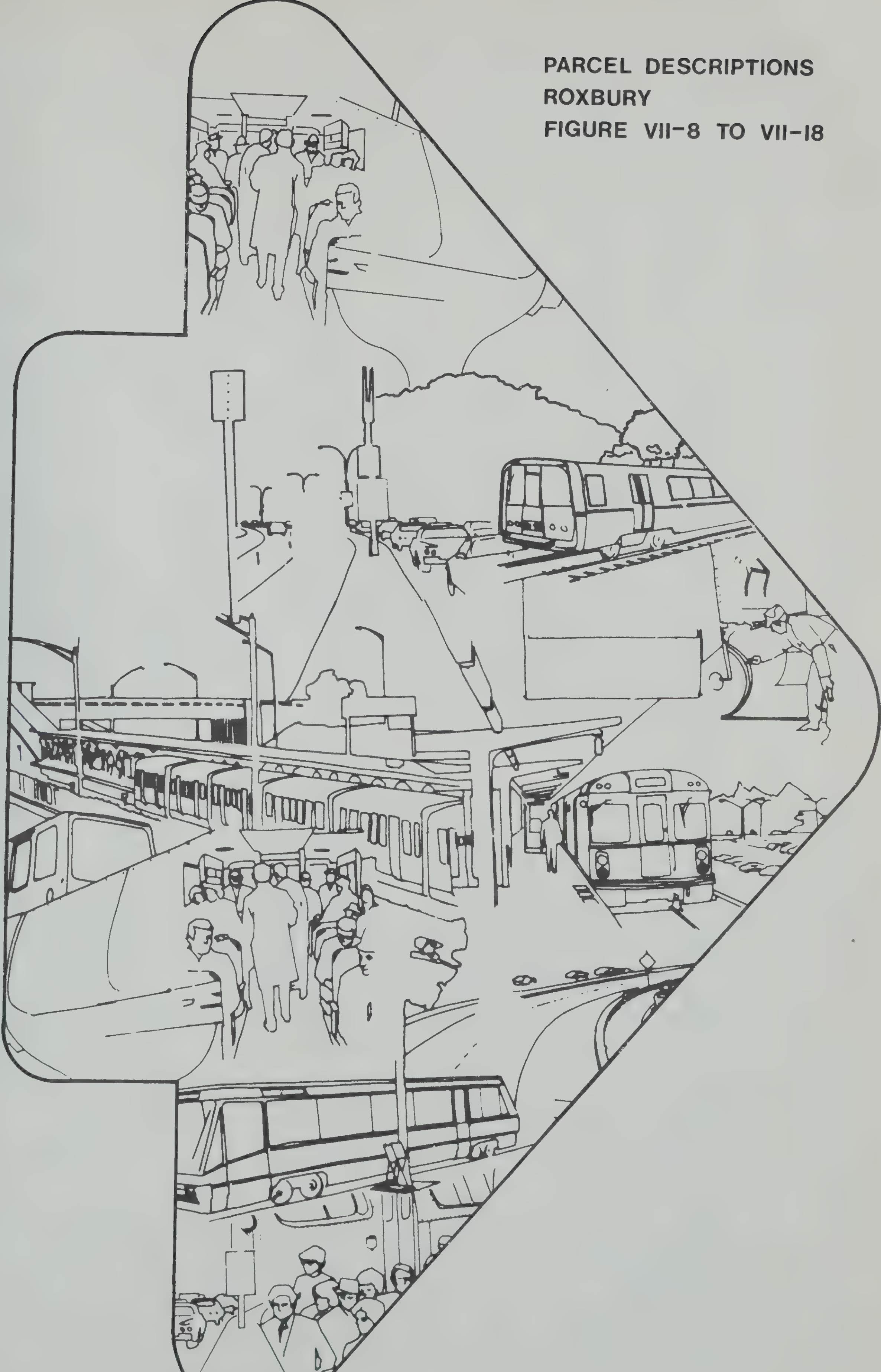


Fig. VII-8 Parcel Descriptions-Roxbury FH-1

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
16	IV-26				Parcel does not exist in this alternative
17	IV-26	56,000	1.29	Open space	Expansion for adjacent Carter Playground.
17X	IV-26	191,000	4.40	Ancillary uses: Transit/Rail Station	Private Ownership
T	IV-76	R U G G L	E S/N O R	T H E A S T E R N S T A T I O N	Air-rights over station; joint development with parcel 18, and Northeastern University.
18	IV-26	131,500	3.02	Retail, hotel, office, institutional, community facility	Major development location adjacent to Station, Northeastern University, and a concentration of new and existing housing.
18a	IV-26	15,000	0.34	Open space reserve for future development	Adjacent to St. Cyprian's Church
18b	IV-26	122,000	2.80	Retail, office, housing, community facility	Large development parcel having extensive street frontage
19	IV-26	26,000	0.60	Open space	Combine with adjacent open space deck.
Deck	IV-26			Open space	Over tracks: area = 102,000SF or 2.34 acres
20	IV-26	73,500	1.69	Retail, housing: community, facility, open space	Adjacent to open space deck
21	IV-25	29,000	0.67	Open Space	Narrow strip (average depth = 50 feet)
22	IV-25	172,500	3.96	Auto oriented commercial, open space	Long, tapering parcel
22a	IV-25	33,000	0.76	Auto oriented commercial	Excellent vehicular access
22b	IV-25	70,000	1.61	Institutional	Campus High School Occupational Resource Center Facilities and Open Space
23	IV-25	7000	0.16	Open space	Small parcel
24	IV-25	107,500	2.47	Institutional	Proposed Roxbury Community College (contains "Third Nail" bldg.)
25	IV-25	13,000	0.30	Manufacturing housing	Small parcel; develop with parcel 25X

Fig. VII-8 Parcel Descriptions-Roxbury FH-1 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
25X	IV-25	66,000	1.52	Manufacturing, Housing	Private Ownership; Area combined with parcel 25 = 1.82 acres
T	IV-78	ROXBURY CROSSING STATION			Retail use within station
25a	IV-25	4500	0.10	Ancillary use Transit Station	Small parcel
26	IV-25	98,000	2.25	Institutional	Proposed Roxbury Community College develop with parcel 26X
26X	IV-25	102,000	2.34	Institutional	Private ownership Area combined with parcel 26 = 4.59 acres
27	IV-24	206,000	4.73	Auto oriented commercial, open space; manufacturing, institutional	The proposed Roxbury Community College could have access to this parcel via bridges over Columbus Avenue.
28	IV-24	109,000	2.50	Institutional	Proposed Roxbury Community College
29	IV-24	48,000	1.10	Open space	Narrow parcel (average depth = 75 ft.)
30	IV-24	40,500	0.93	Institutional	Proposed Roxbury Community College
31	IV-24	25,000	0.57	Manufacturing	Expansion for adjacent manufacturing uses.
32	IV-24	73,000	1.68	Institutional	Proposed Roxbury Community College
T	IV-82	JACKSON SQUARE STATION			Open space on air-rights over station, retail use within station
Deck	IV-24			Open space	Over station and tracks: Area = 55,000 SF/1.26 acres
33	IV-24				Bus loop in this 'alternative'
34	IV-24	31,500	0.72	Retail, housing, community facility, alt: open space	Major development parcel when developed with Parcel 34X
34X	IV-24	223,500	5.13	Retail, housing, community facility, alt: open space	Private ownership and Roxbury Yard - Boston Public Works Dept.: Area combined with parcel 23 = 5.85 acres.
35	IV-24	32,500	0.75	Auto oriented, commercial	Excellent vehicular access
TOTAL		2,077,500	47.69		3.6 acres decked area in this alternative (not included in total)
INSIDE CORRIDOR		1,495,000	34.32		
OUTSIDE CORRIDOR		582,500	13.37		

Fig. VII-9 Parcel Descriptions-Roxbury FH-2

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
16	IV-33	29,000	0.67	Open space; Community facility	Adjacent to Whittier Street Housing; develop with parcel 16X
16X	IV-33	54,000	1.24	Open space; Community facility	In segment 1 Arterial Street; Area combined with parcel 16 = 1.91 acres
17	IV-33	56,000	1.29	Open space	Expansion for adjacent Carter Playground
17X	IV-33	191,000	4.40	Ancillary uses Transit/Rail Station	Private ownership
T	IV-76	RUGGLES/NORTHEASTERN STATION			Air rights over station; joint development with parcel 18 and Northeastern University; retail uses within station
18	IV-33	255,000	5.58	Retail, hotel, office; Community facility, institutional, housing	Major development location adjacent to station, Northeastern University, and a concentration of new and existing housing.
18a	IV-33	15,000	0.34	Open space reserve for future development	Adjacent to St. Cyprian's Church
19	IV-33	26,000	0.60	Open space	Combine with Adjacent Open Space Deck
Deck	IV-33			Open space	Over tracks: area = 102,000 SF/2.34 acres
20	IV-33	92,000	2.11	Retail, housing, community facility, open space	Adjacent to Open Space Deck
21	IV-32	18,500	0.42	Open space	Narrow strip (depth less than 50 feet)
22	IV-32	297,000	6.82	Institutional, Open space	Campus High School and Occupational Resource Center Facilities and Open Space
23	IV-32	8000	0.18	Open space	Narrow strip (depth less than 50 feet)
24	IV-32	66,000	1.52	Institutional	Proposed Roxbury Community College (contains "Third Nail" Building)
25	IV-32	13,000	0.30	Manufacturing, Housing	Small parcel; develop with parcel 25X
25X	IV-32	66,000	1.52	Manufacturing, Housing	Private ownership; area combined with parcel 25 = 1.82 acres
T	IV-78	ROXBURY CROSSING STATION			Retail use within station
25a	IV-32	4500	0.10	Ancillary use Transit Station	Small parcel
26	IV-32	167,000	3.83	Institutional	Proposed Roxbury Community College; develop with parcel 26X

Fig. VII-9 Parcel Descriptions-Roxbury FH-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
26X	IV-32	102,000	2.34	Institutional	Private ownership; proposed Roxbury Community College; area combined with Parcel 26 = 6.17 acres.
27	IV-31	27,000	0.62	Open space	Narrow strip (depth less than 50 feet)
28	IV-31	120,500	2.77	Institutional	Proposed Roxbury Community College
29	IV-31	15,000	0.34	Open space	Narrow strip (depth less than 50 feet)
30	IV-31	40,500	0.93	Institutional	Proposed Roxbury Community College
31	IV-31	25,000	0.57	Manufacturing	Expansion for adjacent manufacturing uses
32	IV-31	58,000	1.33	Institutional	Proposed Roxbury Community College
T	IV-80	J A C K S O	N S Q U A	R E S T A T I O N	Open space on air-rights over station; Retail use within station
Deck	IV-31			Open space	Over station and tracks: Area = 55,000 SF/1.26 acres
33	IV-31				Within station construction in the alternative
34	IV-31	125,000	2.87	Retail, housing, community facility, alt: open space	Major development parcel when developed with Parcel 34X
34X	IV-31	223,500	5.13	Retail, housing, community facility, alt: open space	Private ownership and Roxbury Yard-Boston Public Works: Area combined with parcel 34 = 8 acres.
35	IV-31				Within parcel 34 in this Alternative
TOTALS		2,094,500	48.08		3.6 acres decked area in this alternative (not included in totals)
TOTAL IN CORRIDOR		1,458,000	33.47		
TOTAL ADJACENT		636,500	14.61		

Fig. VII-10 Parcel Descriptions-Roxbury FH-2b

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
T	IV-82	JACKSON	SQU	ARE STATION	Open space on air-rights over station; retail use within station.
Deck	IV-31a			Open space	Over station and tracks: Area = 55,000 SF or 1.26 acres
33	IV-31a				Within Parcel 35 in this Alternative
34	IV-31a	54,500	1.25	Retail, housing, community facility, alt: open space	Major development parcel when combined with parcel 34X
34X	IV-31a	223,500	5.13	Retail, housing, community facility, alt: open space	Private ownership and Roxbury Yard - Boston Public Works: Area combined with parcel 34 = 6.38 acres
35	IV-31a	62,000	1.42	Retail, open space, community facility	Can be linked directly to housing
TOTAL		2,086,000	47.89		3.6 acres decked area in this alternative (not included in totals)
TOTAL IN CORRIDOR		1,449,500	33.28		
TOTAL ADJACENT		636,500	14.63		

Note: Alternative FH-2b is identical to Alternative FH-2 from parcel 16 through parcel 32. Alternative FH-2b aligns Arterial Street into Columbus Avenue at Jackson Square.

Fig. VII-11 Parcel Descriptions-Roxbury FH-2c

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
T	IV-80	JACKSON SQUARE STATION			Open space on air-rights over station; retail use within station
Deck	IV-45a			Open space	Over station and tracks: Area = 55,000 SF or 1.26 acres
33	IV-45a				Within station construction in this alternative
34	IV-45a	117,500	2.70	Retail, housing, community facility, alt: open space	Major development parcel when combined with parcel 34X
34X	IV-45a	223,500	5.13	Retail, housing, community facility, alt: open space	Private ownership and Roxbury Yard: Boston Public Works: Area combined with parcel 34 = 7.83 acres
35	IV-45a	23,000	0.53	Open space	Irregularly shaped parcel
TOTALS		2,110,000	48.44		3.6 acres decked area in this alternative (not included in totals)
TOTAL IN CORRIDOR		1,473,500	33.83		
TOTAL ADJACENT		636,500	14.61		

* Note: Alternative FH-2c is identical to Alternative FH-2 from parcel 16 through parcel 32. Alternative FH-2c terminates Arterial Street at Jackson Square perpendicular to Centre Street.

Fig. VII-12 Parcel Descriptions-Roxbury FH-3

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
16	IV-40				Parcel does not exist in this alternative
17	IV-40	56,000	1.29	Open space	Expansion for adjacent Carter Playground.
17X	IV-40	191,000	4.40	Ancillary uses: Transit/Rail Station	Private Ownership
T	IV-75	RUGGLES/NORTHEASTERN STATION			Retail uses within station
18	IV-40	131,500	3.02	Retail, hotel, office, institutional, community facility	Major development location adjacent to Station, Northeastern University, and a concentration of new and existing housing.
18a	IV-40	15,000	0.34	Open space reserve for future development	Adjacent to St. Cyprian's Church
18b	IV-40	122,000	2.80	Retail, office, housing, community facility	Large development parcel having extensive street frontage.
19	IV-40	26,000	0.60	Open space	Expansion for Mission Hill Extension
No Deck	IV-40				No deck possible in this Alternative
20	IV-40	73,500	1.69	Retail, community facility, open space	Adjacent to Embankment
21	IV-39	29,000	0.67	Open Space	Narrow strip (average depth = 50 feet)
22	IV-39	172,500	3.96	Auto oriented commercial, open space	Long, tapering parcel
22a	IV-39	[illegible]	0.76	Auto oriented commercial	Excellent vehicular access
22b	IV-39	70,000	1.61	Institutional	Campus High School Occupational Resource Center Facilities and Open Space
23	IV-39	7000	0.16	Open space	Small parcel
24	IV-39	107,500	2.47	Institutional	Proposed Roxbury Community College (contains "Third Nail" bldg.)
25	IV-39	13,000	0.30	Manufacturing	Small parcel; develop with parcel 25X
25X	IV-39	66,000	1.52	Manufacturing	Private Ownership; Area combined with parcel 25 = 1.82 acres

Fig. VII-12 Parcel Descriptions-Roxbury FH-3 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
T	IV-88	R O X B U R Y C R O S S I N G S T A T I O N			Retail use within station
25a	IV-39	4500	0.10	Ancillary use Transit Station	Small parcel
26	IV-39	98,000	2.25	Institutional	Proposed Roxbury Community College, develop with parcel 26X
26X	IV-39	102,000	2.34	Institutional	Private ownership Area combined with parcel 26 = 4.59 acres
27	IV-38	206,000	4.73	Auto oriented commercial, open space; manufacturing, institutional	The proposed Roxbury Community College could have access to this parcel via bridges over Columbus Avenue.
28	IV-38	109,000	2.50	Institutional	Proposed Roxbury Community College
29	IV-38	48,000	1.10	Open space	Narrow parcel (average depth = 75 ft.)
30	IV-38	40,500	0.93	Institutional	Proposed Roxbury Community College
31	IV-38	25,000	0.57	Manufacturing	Expansion for adjacent manufacturing uses.
32	IV-38	73,000	1.68	Institutional	Proposed Roxbury Community College
T	IV-88	J A C K S O N S Q U A R E S T A T I O N			Retail use within station
No Deck	IV-38				No deck possible in this Alternative
33	IV-38	26,000	0.60	Open space	
34	IV-38	31,500	0.72	Retail, housing, community facility, alt: open space	Major development parcel when developed with Parcel 34X
34X	IV-38	223,500	5.13	Retail, housing, community facility, alt: open space	Private ownership and Roxbury Yard - Boston Public Works Dept.: Area combined with parcel 23 = 5.85 acres.
	IV-38	32,500	0.75	Auto oriented commercial	Excellent vehicular access
TOTAL		2,103,500	48.29		No decked area exists in this alternative.
[illegible]		1,521,000	34.92		
[illegible]		582,500	13.37		

Fig. VII-13 Parcel Descriptions-Roxbury FH-4

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
[illegible]	IV-47	[illegible]	0.67	Open space; Community facility	Adjacent to Whittier Street Housing; develop with parcel 16X
[illegible]	IV-47	[illegible]	1.24	Open space; Community facility	In segment 1 Arterial Street; Area combined with parcel 16 = 1.91 acres
[illegible]	IV-47	[illegible]	1.29	Open space	Expansion for adjacent Carter Playground
[illegible]	IV-47	191,000	4.40	Ancillary uses Transit/Rail Station	Private ownership
[illegible]	IV-75	RUGGLES/NORTHEASTERN STATION			Retail use within station
[illegible]	IV-47	255,000	5.58	Retail, hotel, office; Community facility, institutional,	Major development location adjacent to station, Northeastern University, and a concentration of new and existing housing.
[illegible]	IV-47	15,000	0.34	Open space reserve for future development	Adjacent to St. Cyprian's Church
[illegible]	IV-47	26,000	0.60	Open space	Expansion for Mission Hill Extension
No [illegible]	IV-47				No deck possible in this Alternative
[illegible]	IV-47	[illegible]	2.11	Retail, community facility, open space	Adjacent to Embankment
[illegible]	IV-46	18,500	0.42	Open space	Narrow strip (depth less than 50 feet)
[illegible]	IV-46	297,000	6.82	Institutional, Open space	Campus High School and Occupational Resource Center Facilities and Open Space
[illegible]	IV-46	[illegible]	0.18	Open space	Narrow strip (depth less than 50 feet)
[illegible]	IV-46	[illegible]	[illegible]	Institutional	Proposed Roxbury Community College (contains "Third Nail" Building)
[illegible]	IV-46	[illegible]	0.30	Manufacturing	Small parcel; develop with parcel 25X
[illegible]	IV-46	[illegible]	1.52	Manufacturing	Private ownership; area combined with parcel 25 = 1.82 acres
	IV-88	ROXBURY CROSSING STATION			Retail use within station
[illegible]	IV-46	[illegible]	0.10	Ancillary use Transit Station	Small parcel
[illegible]	IV-46	[illegible]	[illegible]	Institutional	Proposed Roxbury Community College; develop with parcel 26X

Fig. VII-13 Parcel Descriptions-Roxbury FH-4 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
[illegible]	IV-46	[illegible]	2.34	Institutional	Private ownership; proposed Roxbury Community College; area combined with Parcel 26 = 6.17 acres.
[illegible]	IV-45	[illegible]	[illegible]	Open space	Narrow strip (depth less than 50 feet)
[illegible]	IV-45	[illegible]	2.77	Institutional	Proposed Roxbury Community College
[illegible]	IV-45	[illegible]	0.31	Open space	Narrow strip (depth less than 50 feet)
[illegible]	IV-45	[illegible]	0.93	Institutional	Proposed Roxbury Community College
[illegible]	IV-45	[illegible]	0.57	Manufacturing	Expansion for adjacent manufacturing uses
[illegible]	IV-45	[illegible]	1.33	Institutional	Proposed Roxbury Community College
[illegible]	IV-88	J A C K S O N	S Q U A	R E S T A T I O N	Retail use within station
No [illegible]	IV-45				No deck possible in this Alternative
[illegible]	IV-45	17,500	0.40	Open space	Narrow strip (depth less than 50 feet)
[illegible]	IV-45	[illegible]	2.87	Retail, housing, community facility, alt: open space	Major development parcel when developed with Parcel 34X
[illegible]	IV-45	223,500	5.13	Retail, housing, community facility, alt: open space	Private ownership and Roxbury Yard-Boston Public Works: Area combined with parcel 34 = 8 acres.
[illegible]	IV-45				Within parcel 34 in this Alternative
[illegible]		2,112,000	48.48		No decked area exists in this alternative
[illegible]		1,475,500	33.87		
[illegible]		636,500	14.61		

Fig. VII-14 Parcel Descriptions-Roxbury FH-4a

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
	IV-38	JACKSON SQUARE STATION			Retail use within station
No [illegible]	IV-31a				Deck not possible in this Alternative
	IV-31a				Within Parcel 35 in this Alternative
	IV-31a	54,500	1.25	Retail, housing, community facility, alt: open space	Major development parcel when combined with parcel 34X
	IV-31a	223,500	5.13	Retail, housing, community facility, alt: open space	Private ownership and Roxbury Yard - Boston Public Works: Area combined with parcel 34 = 6.48 acres
	IV-31a	62,000	1.42	Retail, open space	Adjacent to station
[illegible]		2,086,000	47.89		No decked area exists in this alternative
[illegible]		1,449,300	33.28		
[illegible]		636,500	14.61		

*Note: Alternative Fh-4a is identical to Alternative FH-4 from parcel 16 through parcel 32. Alternative FH-4a aligns Arterial Street into Columbus Avenue at Jackson Square.

Fig. VII-15 Parcel Descriptions-Roxbury FH-4b

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
	IV-88	[illegible] SQUARE STATION			Retail use within station
No Deck	IV-45a				Deck not possible in this Alternative
[illegible]	IV-45a	21,500	0.49	Open space	Narrow strip (depth less than 50 feet)
[illegible]	IV-45a	[illegible]	[illegible]	Retail, housing, community facility, alt: open space	Major development parcel when combined with parcel 34X
[illegible]	IV-45a	[illegible]	[illegible]	Retail, housing, community facility, alt: open space	Private ownership and Roxbury Yard: Boston Public Works: Area combined with parcel 34 = 7.83 acres
[illegible]		23,000	0.53	Open space	Irregularly shaped parcel
[illegible]		2,131,500	48.93		No decked area exists in this alternative
[illegible]		1,495,000	34.32		
[illegible]		636,500	14.61		

*Note: Alternative FH-4b is identical to Alternative FH-4 from parcel 16 through parcel 32. Alternative FH-4b terminates Arterial Street at Jackson Square perpendicular to Centre Street.

Fig. VII-16 Parcel Descriptions - Roxbury FH-5 and PHP-2

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
16	IV-55	29,000	0.67	Open space: Community facility	Adjacent to Whittier Street Housing: develop with parcel 16X
16X	IV-55	54,000	1.24	Open space: Community facility	In segment 1 Arterial Street: Area combined with parcel 16 = 1.91 acres
17	IV-55	56,000	1.29	Open space	Expansion for adjacent Carter Playground
17X	IV-55	191,000	4.40	Ancillary uses Transit/Rail Station	Private ownership
T	IV-77	R U G G L	E S/N O R	T H E A S T E R N S T A T I O N	Air rights over station; joint development with parcel 18 and Northeastern University: retail uses within station.
18	IV-55	255,000	5.58	Retail, hotel, office; Community facility, institutional, housing	Major development location adjacent to station, Northeastern University, and a concentration of new and existing housing.
18a	IV-55	15,000	0.34	Open space reserve for future	Adjacent to St. Cyprian's Church
19	IV-55	33,000	0.76	Open space	Combine with Adjacent Open Space Deck
Deck	IV-55			Open space	Over tracks: area = 106,000 SF/2,43 acres
20	IV-55	105,000	2.41	Retail, housing, community facility, open space	Adjacent to Open Space Deck
21	IV-54	12,000	0.28	Manufacturing	Narrow strip shlping down to tracks. Abuts adjacent manufacturing.
22	IV-54	267,000	6,13	Institutional, Open Space	Campus High School and Occupational Resource Center Facilities and Open Space
23	IV-54	3,000	0.07	Open space	Narrow strip (depth less than 50 feet)
24	IV-54	54,500	1.25	Institutional	Proposed Roxbury Community College (contains "Third Nail" Building)
25	IV-54	83,500	1.92	Manufacutirng housing, and/or retail	Portion of land slopes down to tracks
25a	IV-54	10,000	0.23	Manufacturing Open Space	Small Parcel.
26	IV-54	141,000	3.24	Institutional	Proposed Roxbury Community College, develop with Parcel 26X

Fig. VII-16 Parcel Descriptions - Roxbury FH-5 and PHP-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
26X	IV-54	102,000	2.34	Institutional	Private ownership; proposed Roxbury Community College; area combined with parcel 26 = 5.58 acres
T	IV-79	ROXBURY CROSSING STATION			Retail use within station
27	IV-53	8,000	0.18	Open space	Narrow strip
27a	IV-54	59,000	1.35	Retail manufacturing	Narrow strip sloping down to tracks. Abuts adjacent manufacturing. Retail at Tremont Street.
27b	IV-53	29,000	0.67	Manufacturing	Narrow stip. Expansion for adjacent manufacturing.
28	IV-53	114,000	2.62	Institutional	Proposed Roxbury Community College
29	IV-53	6,000	0.14	Open space	Narrow strip
30	IV-53	36,000	0.83	Institutional	Proposed Roxbury Community College
31	IV-53	40,000	0.92	Manufacturing	Expansion for adjacent manufacturing uses
32	IV-53	38,000	0.87	Institutional	Proposed Roxbury Community College
32a	IV-53	7,000	0.16	Retail,housing, open space	Small parcel, may be sold to abuttors
T	IV-81	JACKSON SQUARE STATION			Open space on air-rights over station; Retail use within station
Deck	IV-53			Open space	Over station and tracks: Area = 55,000 SF/1.26 acres
33	IV-53				Within station construction in the alternative
34	IV-53	119,000	2.73	Retail, housing, community facility, alt: open space	Major development parcel when developed with Parcel 34X
34X	IV-53	219,000	5.03	Retail, housing, community facility, alt: open space	Private ownership and Roxbury Yard-Boston Public Works: Area combined with parcel 34 = 7.76 acres.
35	IV-53				Within parcel 34 in this Alternative

Fig. VII-16 Parcel Descriptions - Roxbury FH-5 and PHP-2 (Continued)

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
Totals		2,086,000	47.65		3.6 acres decked area in this alternative (not included in totals)
Total in Corridor		1,520,000	34.64		
Total Adjacent		566,000	13.01		

Fig. VII-17 Parcel Descriptions-Roxbury FH-6 and PHP-1

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
T	IV-83	JACKSON	SQUARE STATION		Open space on air-rights over station: Retail use within station
Deck	IV-60			Open space	Over station and tracks: Area = 55,000 SF/1.26 acres
33	IV-60				Within station construction in the alternative
34	IV-60	46,000	1.05	Retail, housing, community facility, alt: open space	Major development parcel when developed with Parcel 34X
34X	IV-60	219,000	5.03	Retail, housing, community facility, alt: open space	Private ownership and Roxbury Yard-Boston Public Works: Area combined with parcel 34 = 6.08 acres.
35	IV-60	73,000	1.68	Retail, open space, community facility	
Totals		2,086,000	47.65		3.6 acres decked area in this alternative (not included in totals)
Total in Corridor		1,520,000	34.64		
Total Adjacent		566,000	13.01		

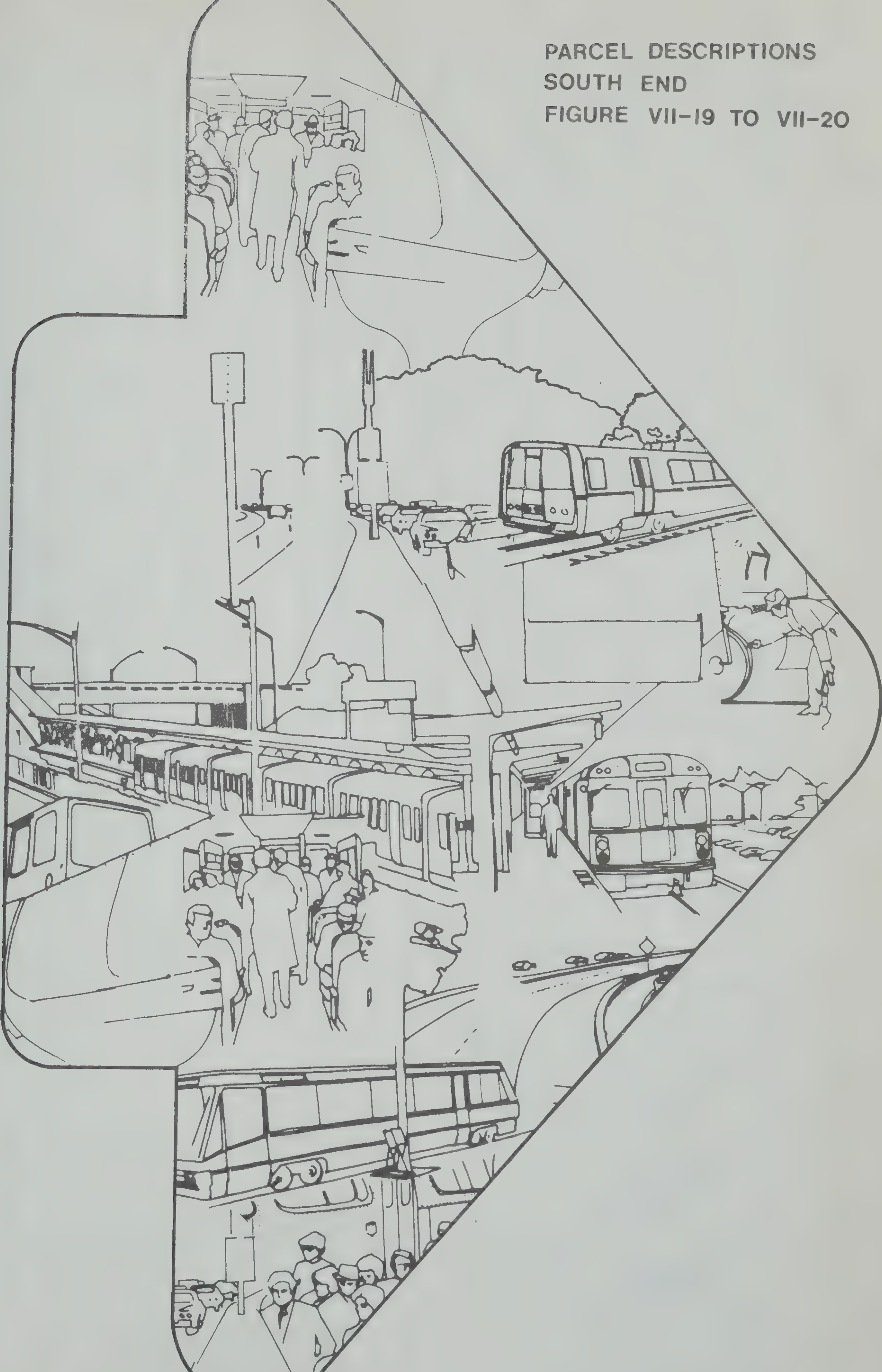
Fig. VII-18 Parcel Descriptions-Roxbury FH-6a

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS

Note: Parcels in Alternative FH-6a are identical to parcels in Alternative FH-5 (Fig. VII-16)

The arterial street in Alternative FH-6a terminates at Jackson Square perpendicular to Centre Street.

PARCEL DESCRIPTIONS
SOUTH END
FIGURE VII-19 TO VII-20



SUMMARY
SOUTH END

Fig. VII-23

DEVELOPMENT POTENTIAL

ALTERNATIVES	HOUSING 1-4 FAMILY (D.U.)	HOUSING MULTI FAMILY (D.U.)	HOTEL/MOTEL (ROOMS)	RETAIL AND SERVICE RETAIL (SF BLDG AREA)	AUTO-ORIENTED COMMERCIAL (SF LAND AREA)	OFFICE (SF BLDG. AREA)	MANUFACTURING (SF BLDG. AREA)	INSTITUTIONAL (SF LAND AREA)	OPEN SPACE (SF LAND AREA)	COMMUNITY FACILITY (VARIOUS UNITS)	SELL TO ABUTTORS (SF LAND AREA)	RESELL AS IS (VARIOUS UNITS)
SC-1 & PHP 1 & 2		21		62,500		180,000			4,100			
SC-2		9		58,500		180,000						

NOTE: (1) PARCELS 1 AND 2 ARE PROPOSED FOR JOINT DEVELOPMENT WITH MASSACHUSETTS AVENUE STATION HAVING GROUND FLOOR RETAIL AND SMALL OFFICES ABOVE; HOUSING MAY BE AN ALTERNATE USE.

EXPLANATION OF NOTES AND SYMBOLS:

0 INDICATES DEDICATION OF A PORTION OF THE PARCEL FOR OPEN SPACE USE TO ACCOMMODATE SUCH USES AS THE REGIONAL TRAIL, BIKE PATH, AND A "GREEN-BELT" CONCEPT.

00 INDICATES THE POSSIBILITY OF PROVIDING A COMMUNITY FACILITY AS PART OF THE PROPOSED DEVELOPMENT. THIS FACILITY COULD TAKE MANY FORMS, SUCH AS A HEALTH CENTER, COMMUNITY CENTER, A RECREATIONAL FACILITY, ETC.

Fig. VII-22 (Continued)

Summary - Development Potential - Roxbury

Explanation of notes and symbols:

o Indicates dedication of a portion of the parcel for open space use to accommodate such uses as the Regional Trail, bike path, and a "green-belt" concept.

oo Indicates the possibility of providing a community facility as part of the proposed development. This facility could take many forms, such as a health center, community center, a recreational facility, etc.

(1) In Alternatives FH-1 and FH-3, parcel 18 could be developed for 150,000 S.F. of office space or some unit of institutional use rather than the hotel indicated. Also, retail space could be expanded greatly and the other uses reduced accordingly.

(2) In Alternatives FH-1 and FH-3, parcel 18b could be developed for 200 residential units or 150,000 S.F. of office space with retail use reduced accordingly.

(3) In Alternative FH-1, FH-2, FH-5, and FH-6, and in Alternatives FH-5 and FH-6 parcel 25 and parcel 20 could be developed for 100 to 150 residential units rather than the indicated retail.

(4) In Alternatives FH-1, FH-2 parcel (25 + 25X); could be developed for 100 to 150 residential units rather than the indicated manufacturing use.

(5) In Alternatives FH-1 and FH-3 parcel 27 could be developed for manufacturing uses (100,000 S.F.) or an extension of Roxbury Community College (reached via bridges across Columbus Avenue from their man location) rather than the indicated auto-oriented uses.

(6) In all alternatives parcel (34 + 34X) could be developed for major open space use rather than the housing and retail use indicated.

(7) In Alternatives FH-2, FH-4, FH5, and FH-6, parcel 19 could be developed for 300 residential units and/or some unit of institutional uses: the hotel and retail use indicated would be reduced accordingly.

(8) In Alternatives FH-5 and FH-6 land abutting manufacturing uses having a 1:2 slope.

SUMMARY
ROXBURY

Fig. VII-22 DEVELOPMENT POTENTIAL -

ALTERNATIVE	HOUSING 1-4 FAMILY (D.U.)	HOUSING MULTI FAMILY (D.U.)	HOTEL/MOTEL (ROOMS)	RETAIL AND SERVICE RETAIL (SF BLDG AREA)	AUTO-ORIENTED COMMERCIAL (SF LAND AREA)	OFFICE (SF BLDG. AREA)	MANUFACTURING (SF BLDG.AREA)	INSTITUTIONAL (SF LAND AREA)	OPEN SPACE (SF LAND AREA)	COMMUNITY FACILITY (VARIOUS UNITS)	SELL TO ABUTTORS (SF LAND AREA)	RESELL AS IS (VARIOUS UNITS)
FH-1		200	300	175,000	444,000		52,500	600,000	181,000			
FH-2		200	300	175,000		150,000	52,500	851,000	248,500			
FH-2a		200	300	200,000		150,000	52,500	851,000	248,500			
FH-2b		200	300	175,000		150,000	52,500	851,000	293,000			
FH-3		200	300	175,000	440,000		52,500	600,000	207,000			
FH-4		200	300	175,000		150,000	52,500	851,000	266,000			
FH-4a		200	300	175,000		150,000	52,500	851,000	266,000			
FH-4b		200	300	175,000		150,000	52,500	851,000	310,500			
FH-5 & PHP-2		200	300	185,000		150,000	79,000	752,000	204,000			
FH-6 & PHP-1		200	300	210,000		150,000	79,000	752,000	204,000			
FH-6a		200	300	185,000		150,000	79,000	752,000	204,000			
See Footnoes		(2) (3) (4)				(1) (2)	(5) (8)	(1) (5) (7)	(6)			

SUMMARY
JAMAICA PLAIN

Fig. VII-21

DEVELOPMENT POTENTIAL

ALTERNATIVE	HOUSING 1-4 FAMILY (D.U.)	HOUSING MULTI FAMILY (D.U.)	HOTEL/MOTEL (ROOMS)	RETAIL AND SERVICE RETAIL (SF BLDG AREA)	AUTO-ORIENTED COMMERCIAL (SF LAND AREA)	OFFICE (SF BLDG. AREA)	MANUFACTURING (SF BLDG.AREA)	INSTITUTIONAL (SF LAND AREA)	OPEN SPACE (SF LAND AREA)	COMMUNITY FACILITY (VARIOUS UNITS)	SELL TO ABUTTORS SF LAND AREA)	RESELL AS IS (VARIOUS UNITS)
FH-1	106	71	200	149,300	604,472	20,000	104,726	1,336,700	1,113,762	varies	285,251	81,684
					(13.88A)			(30.69A)	(25.57A)		(6.55A)	
FH-2	109	89	200	139,300	467,011	20,000	104,726	1,336,700	1,068,762	varies	136,792	81,684
					(10.72A)			(30.69A)	(24.54A)		(3.14A)	
FH-3	108	77	200	106,800	594,020	20.000	104,726	1,336,700	1,148,362	varies	288,786	79,444
					(13.64A)			(30.69A)	(26.36A)		(6.63A)	
FH-4	106	89	200	101,800	460,359	20,000	104,726	1,336,700	1,022,962	varies	264,751	81,684
					(10.57A)			(30.69A)	(23.48A)		(6.08A)	
FH-5 and PHP-2	138	89	200	148,200	452,470	20,000	104,726	1,325,700	1,035,892	varies	119,771	123,526
					(10.39A)			(30.43A)	(23.78A)		(2.75A)	
FH-6 and PHP-1	120	81	200	154,300	496,517	20,000	104,726	1,335,700	1,145,692	varies	222,771	123,526
					(11.40A)			(30.66A)	(26.30A)		(5.11A)	

DEVELOPMENT POTENTIAL
JAMAICA PLAIN
FIGURE VII-21 TO VII-29

Fig. VII-20 Parcel Descriptions-South End SC-2

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
T	IV-74	M A S S A C	H U S E T	T S A V E N U E S T A T I O N	Retail use within station
1	IV-66	3,000	0.07	Residential, retail,office and/or open space	Joint Development Parcel
2	IV-66	7,600	0.17	Residential, retail, office and/or open space	Joint Development Parcel
T	IV-70&71	B A C K	B A Y S	T A T I O N	Retail uses within station; office space on air-rights over station
3	IV-67	3,500	0.08	Residential, retail, office and/or open space	Parcel could be developed with adjacent parking lot

Fig. VII-19 Parcel Descriptions-South End SC-1 and PHP-1 & 2

PARCEL NO.	DWG. NO.	AREA SQ. FT.	AREA ACRES	LAND USES	COMMENTS
T	IV-74	MASSACHUSETTS AVENUE STATION			Retail use within station
1	IV-63	3,000	0.07	Residential, retail office, and/or open space	Joint Development Parcel
2	IV-63	7,600	0.17	Residential, retail office, and/or open space	Joint Development Parcel
T	IV-70&71	BACK BAY STATION			Retail uses within station; office space on air-rights over station
3	IV-64	3,500	0.08	Residential, retail and/or open space	Parcel could be developed with adjacent parking lot. Landscaped and fenced.
4	IV-64	2,100	0.05	Open space	May be sold to abuttor(s) . Landscaped and fenced
5	IV-64	2,000	0.04	Open space	May be sold to abuttor(s). Landscaped and fenced
6	IV-65	4,000	0.09	Residential, retail, and/or open space	
7	IV-65	900	0.02	Commercial	Possible resale to present owner

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

OPEN SPACE PLAN

- (H) HISTORIC STRUCTURE
- (I) INSTITUTION
- (R) RECREATION FACILITY
- (C) COMMUNITY SERVICE FACILITY

←•••• PRIMARY PATH (BICYCLES/PEDESTRIANS)

←······ SECONDARY LINKAGES

SCALE

NORTH

0 1200 2400 3600

FIGURE A-14

FREDERIC R. HARRIS INC.

SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

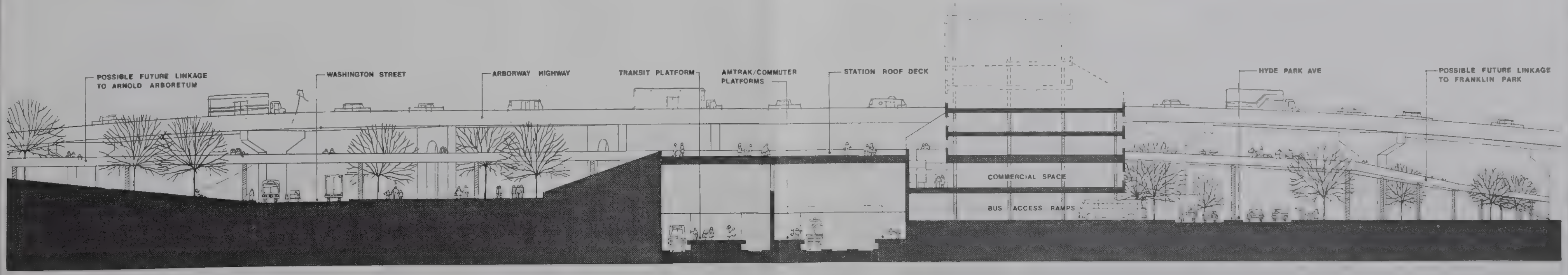
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

FOREST HILLS STATION AREA

SECTION 4-F, 106

THE ARBORWAY (OLMSTED PARK SYSTEM)

STATION OPEN SPACE PLAN



SECTION A

NO SCALE

FIGURE A-15

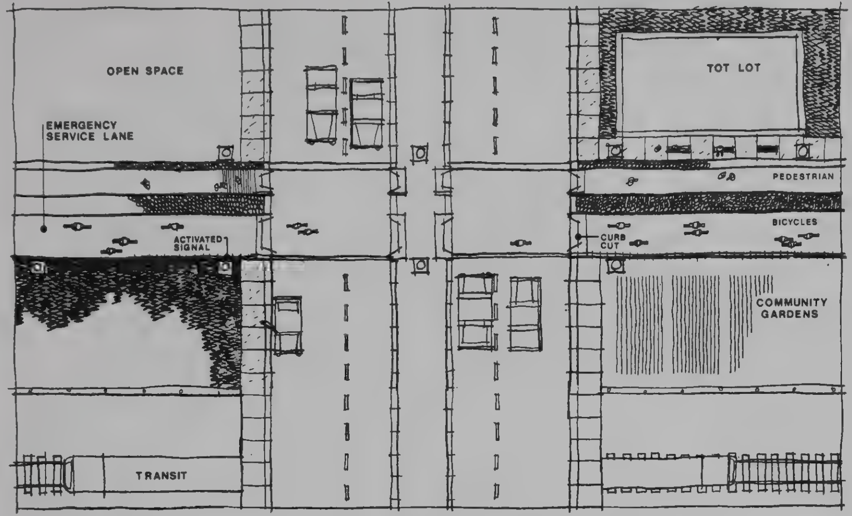
SOUTHWEST CORRIDOR TRANSPORTATION IMPROVEMENTS

ENVIRONMENTAL IMPACT ANALYSIS

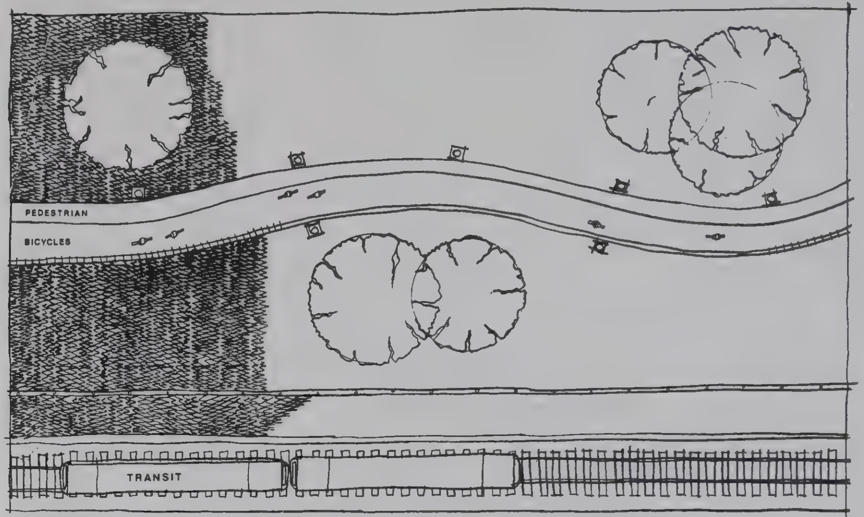
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

PROPOSED PEDESTRIAN, BICYCLE PATH

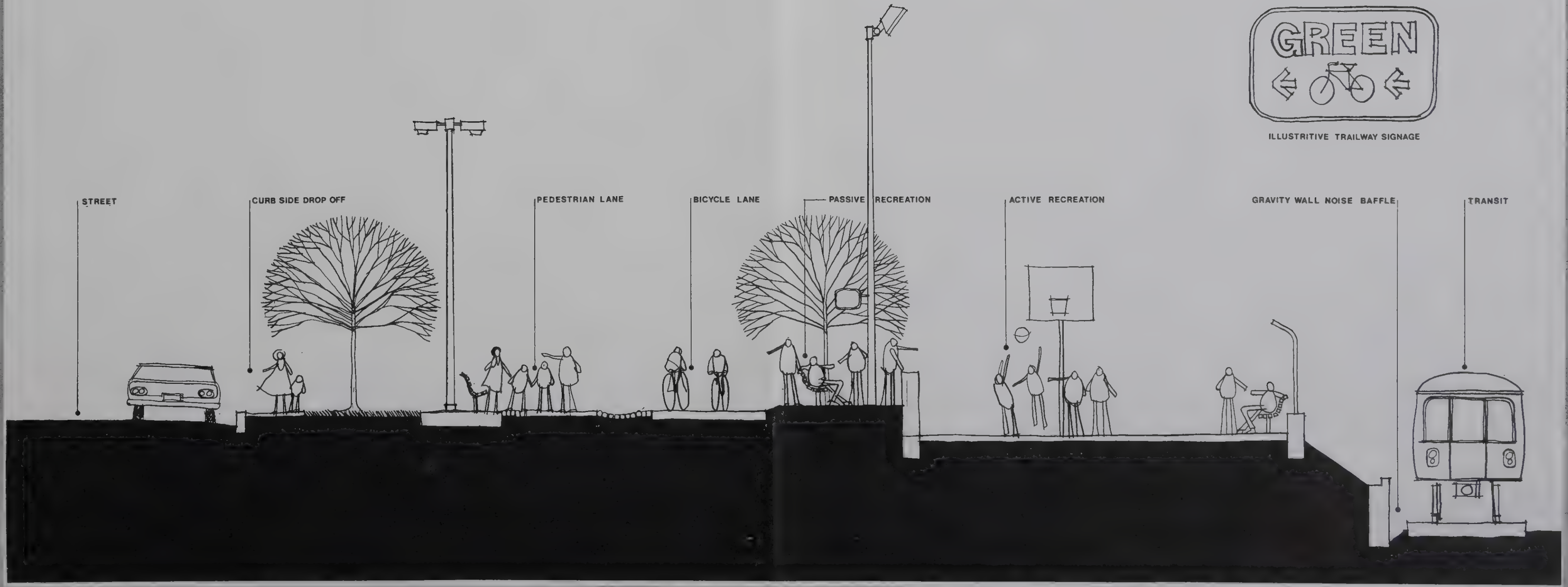
ARCHITECTURAL DETAILS



STREET CROSSING



CONTINUOUS GREEN SPACE



ILLUSTRITIVE TRAILWAY SIGNAGE

NO SCALE

FIGURE A-16

CHAPTER EIGHT:
IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

8.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Certainly, there are irreversible and irretrievable commitments which will be required to accommodate the range of transit alternatives for the Southwest Corridor. Before they are considered, however, it is important to point out those commitments which have been made previously. Fig. VIII-1 shows a chronology of major actions related to the Southwest Corridor transportation options and their implications for resource use. The chronological order of these resource uses shows that the development from the original highway and transit program to the present alternatives has come about as the result of a series of actions over a long period of time. The change from the original plans for the Corridor to those now preferred by the Commonwealth has and will substantially reduce the irretrievable and irreversible use of commitment of resources.

The following discussion points out major positive as well as negative consequences of resource use. They are discussed in order to encourage a balanced consideration of the net value of commitments of resources for Southwest Corridor transportation improvements.

8.1 Land Resources

The overall pattern of financial decisions in the past has been to make expenditures for highway and transit improvements. Due to highway and transit decisions made prior to the Highway Moratorium and BTPR, the following irreversible and irretrievable commitments of resources have been made:

- Land acquisition funds have been spent; lands have been cleared for portions of the Inner Belt Corridor and the Southwest Expressway Corridor to Forest Hills. Some properties have been acquired, but extensive clearance has not taken place south of Forest Hills. These actions have involved substantial community disruption in the Corridor.

- The Penn Central Mainline and tributary commuter lines have been acquired by the MBTA through a $19 million loan from UMTA. Repayment of this loan is a portion of the projected cost of the Relocated Orange Line Project and high-speed intercity rail project.

8.2 Transportation Service

The overall trend has been a reduction of the proposed level of highway service in the Corridor itself. However, the levels of highway service on local feeder streets and in the downtown area will improve and will not deteriorate as much as with the proposed arterial. There will be an increase in the proposed level of transit service along with a more balanced relationship of types of rail service inthe Corridor.

The acquisition of the railroad lines by the MBTA has assured that commuter-rail service and AMTRAK service to Boston can be maintained. This acuqisition does not necessarily mean that the newly purchased rights-of-way must be transformed into rapid-transit corridors. In fact, with the exception of the segment of the right-of-way between Forest Hills and downtown, there have been no permanent commitments made toward further rapid-transit lines in the corridor. Studies underway may extend future rapid-transit to the vicinity of Needham, but that decision has not yet been made.

Improvements planned for the Norwood/Franklin commuter railroad branch represent a commitment to continued rail service in the corridor.

Both alternatives for the use of the Penn Central Shoreline provide for a fifth track for operations of rail service. This commitment would provide for improved flexibility for increased rail use in the future--an option which is not presently available, due to the contraints of the existing embankment. In the depressed alignments, transit and railroad services are enhanced by the Southwest Corridor transportation improvements because of the superior local environmental conditions created and in spite of much increased service. These provisions preserve financial investments in community housing, and in transportation elements. They also maximize the use of the rail corridor for transit and rail service without harm to the environment.

8.3 Community Impacts

Although there have been significant community impacts due to the property takings, demolition, and long period of inaction in the Corridor, the proposed transit project minimizes future negative consequences for the community resulting from the use of resources for these transportation improvements. Additionally, land development in the Corridor, particularly with depression of the rail lines, offers opportunities for retrieving resources in a manner that is a long-range benefit to the community and which can move toward insuring the quality and vitality of the communities in the Southwest Corridor.

The overall changes which the Relocated Orange Line would effect are generally positive. The depressed-rail-facilities alternative would have fewer long-range impacts because of the reduction of visual and noise intrusion into adjacent communities, particularly in cases of large service increases. The modified-embankment alternative would have somewhat greater impacts for communities because of the enlarged scale of the embankment after reconstruction.

All alternatives contain impacts due to land takings required. These takings are irretrievable, if effectuated. However, the increased importance of the cleared land, as it relates to the improved transportation network, is expected to bring about renewed interest in development in the area, thereby reducing the net overall long-term negative impacts of land takings to the adjacent communities.

Elimination of the El will release some land for other use, as well as benefiting land adjacent to the structure.

8.4 Environmental Quality and Natural Resources

The irreversible and irretrievable commitments of resources in the category of environmental quality can be described in terms of a comparison of what presently exists in the Corridor and what is being proposed under the various alternatives.

The Corridor as it exists today centers around a rail line extending from the area of Shawmut Avenue to Forest Hills. The abutting properties are of mixed uses which include residential, commercial industrial and a significant amount of cleared land. The local street system is a series of typical narrow, short city streets which were construct d to accommodate local traffic only. Utilization of the rail corridor is by AMTRAK and Commuter Rail with stops at Back Bay Station and commuter stops at Forest Hills Station.

Under all of the proposed build alternatives, the cleared land would be developed to blend into the neighborhood in a way which would be most advantageous to the neighborhood, though this is more easily accomplished and of greater impact in the depressed alternatives. A large amount of open space (a green belt) has been planned for the Corridor.

The local streets under the no-arterial alternatives would be reconstructed only at the proposed station areas and at the rail/transit crossings. Crossing of the rail/transit, either over or under, would be designed to current standards. In the build-arterial alternatives, the arterial street would carry the traffic now borne by the local streets and allow them to revert back to accommodating only local traffic.

The rail facility under the proposed alternative would include a rapid-transit facility with new stations located at Massachusetts Avenue, Ruggles Street, Roxbury Crossing, Jackson Square, Boylston Street and Green Street; and new commuter rail stations located at Back Bay, Ruggles Street and Forest Hills; and an AMTRAK facility with a station at Back Bay. In addition, the existing Washington Street elevated transit structure would be removed.

The actual construction of the project would commit various materials such as sand, gravel and cement to be used for retaining walls, slabs, station structures and roadways. It is not expected that any of the materials used will severely deplete resources that are currently in short supply either in the study area or in other parts of the country.

Fossil fuel resources will be utilized during the construction phase through the operation of mechanical equipment and in the operation of vehicles transporting materials and the labor force to the project site.

FIG. VIII-1

PREVIOUS COMMITMENTS IN SOUTHWEST CORRIDOR

	ACTION TAKEN	CONSEQUENCES	FINANCIAL	TRANSPORTATION	COMMUNITY IMPACTS	ENVIRONMENTAL QUALITY
1948-1969	Design and development of Relocated Orange Line	Construction of South Cove Tunnel; pending acquisition of rail right-of-way	13.3 million spent for construction of S. Cove Tunnel	Rapid transit program designed to replace commuter rail system.	Transit - well linked to local renewal plans; Highway-large takings north for Forest Hills; major inducement to development in suburbs.	Transit - little impact at S. Cove, highway-major takings of natural resources, possibly irretrievably less.
	Design and development of Southwest Expressway and Inner Belt	Acquisition and clearance of right-of-way, particularly north of Forest Hills.	$23 million spent for land acquisition for SW Expressway	Superior Highway development		
1970	Moratorium on construction of certain highways inside Rte. 128, including Inner Belt and Southwest Expressways.	Suspension of land acquisition and use for expressway except for hardship cases.	No change	No change	Cleared lands unused; downgrading of quality of residential areas & commercial activity in corridor.	No change
	Continuation of Relocated Orange Line Project	Continuation of South Cove Tunnel construction				
1971	BTPR instituted; completion of Phase I leads to Governor's decisions; eliminate portions of proposed Inner Belt; eliminate consideration of any expressway having more than 4 general-purpose and 2 special purpose traffic lanes.	Continued suspension of land acquisition, reduced expressway scale requires less overall width; allows full railroad and transit program; elimination of Inner Belt reduces land taking requirements for interchange area at Southwest expressway.	lower costs for proposed highway; raised costs to minimize impacts.	Lower level of highway service; possibility of new role for transit and more balanced transit/highway program for corridor.	Probable reduced impacts due to reduced scale for highway, with less traffic carrying capacity.	Probable reduced air and noise impacts due to smaller highway dimensions; probable smaller impact on natural resources.
1972	Purchase of Penn Central Mainline right-of-way by MBTA	Assurance of potential use of rail right-of-way for transit purposes.	Commitment to larger expenditures for transit. $19 million spent for acquisition of Penn Central Mainline and other rail connections.	MBTA assumes responsibility for maintenance of rail service on acquired line; possible revival of commuter rail service under public auspices.	Provision for sufficient width for construction without significant further land takings north of Forest Hills.	
Nov. 1972	Decision by Governor to eliminate SW expressway from further consideration and to proceed with arterial street proposal	Reduced land taking requirements, land made available for concurrent development with transport program		Commitment to use transit and rail commuter service for major corridor commu- improvements; local highway needs to be met partially through new arterial street.	Elimination of further major land takings throughout the corridor, development of cleared lands in concert with community needs.	No further threat to natural resources; reduced air and noise pollution potential with reduced highway development.
	Decision to continue plans for Relocated Orange Line coupled with commitment to provide replacement service for existing elevated line; deferred decision to depress embankment for Relocated Orange Line.	Reaffirmation of transit proposal and commitment to seek expanded public funding for transit program	Commitment to proceed with previously planned Relocated Orange Line without highway subsidy for land takings.			
1973	Decision by Governor to depress Relocated Orange Line and to remove embankment as part of over-all program		Raised cost of over-all transit project; reduced costs for potential impacts to communities in corridor	Greater flexibility in operations due to added fifth track.	Reduced visual, barrier, impacts air & noise pollution potential in communities; raised potential for land development	Maximum improvement from depression; arterial street as replacement for existing streets.